ONTARIO
DEPARTMENT OF MINES

SUMMARY OF FIELD WORK, 1968
by the
GEOLOGICAL BRANCH

Compliments of
ONTARIO
MINISTRY OF NORTHERN DEVELOPMENT
AND MINES

Not for resale

Edited by V. G. Milne

MISCELLANEOUS PAPER 22

DECEMBER, 1968

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SUMMARY OF FIELD WORK, 1968

by the

GEOLOGICAL BRANCH

ONTARIO DEPARTMENT OF MINES

INTRODUCTION

by

E. G. Pye[1]

In 1968 the Geological Branch of the Ontario Department of Mines placed 24 geological parties, a geochemical party and a geophysical survey party, in the field, involving the services of 122 persons, and undertook work on 30 projects. Most projects were under the direction of Department field geologists of the Surveys Section. Five were conducted by the Industrial Minerals Section; and two by Resident Geologists who served in the capacity of field geologists in addition to carrying out the normal, routine duties of their offices.

The locations of the areas investigated during the field season are shown on the map of the Province, page 2. The results of the work are outlined in this summary, which contains reports prepared by each of the project leaders. In the reports, emphasis has been placed on the economic aspects of the different investigations. It is the hope of the Geological Branch that the information thus provided will help in the selection of favourable areas for prospecting and so will be a valuable aid to mineral exploration in the Province.

Coloured maps and final detailed reports covering most of the field projects are being prepared for publication. In the interim, however, uncoloured preliminary geological maps with comprehensive marginal notes, will be released for distribution mostly during the winter of 1968-69. These will be published at the field scale of 1 inch to 1/4 mile or 1 inch to 1 mile or 1 inch to 2 miles. Notices of the releases will be mailed to all persons or organizations on the Ontario Department of Mines notification list, and will be published in the technical journals and other media.

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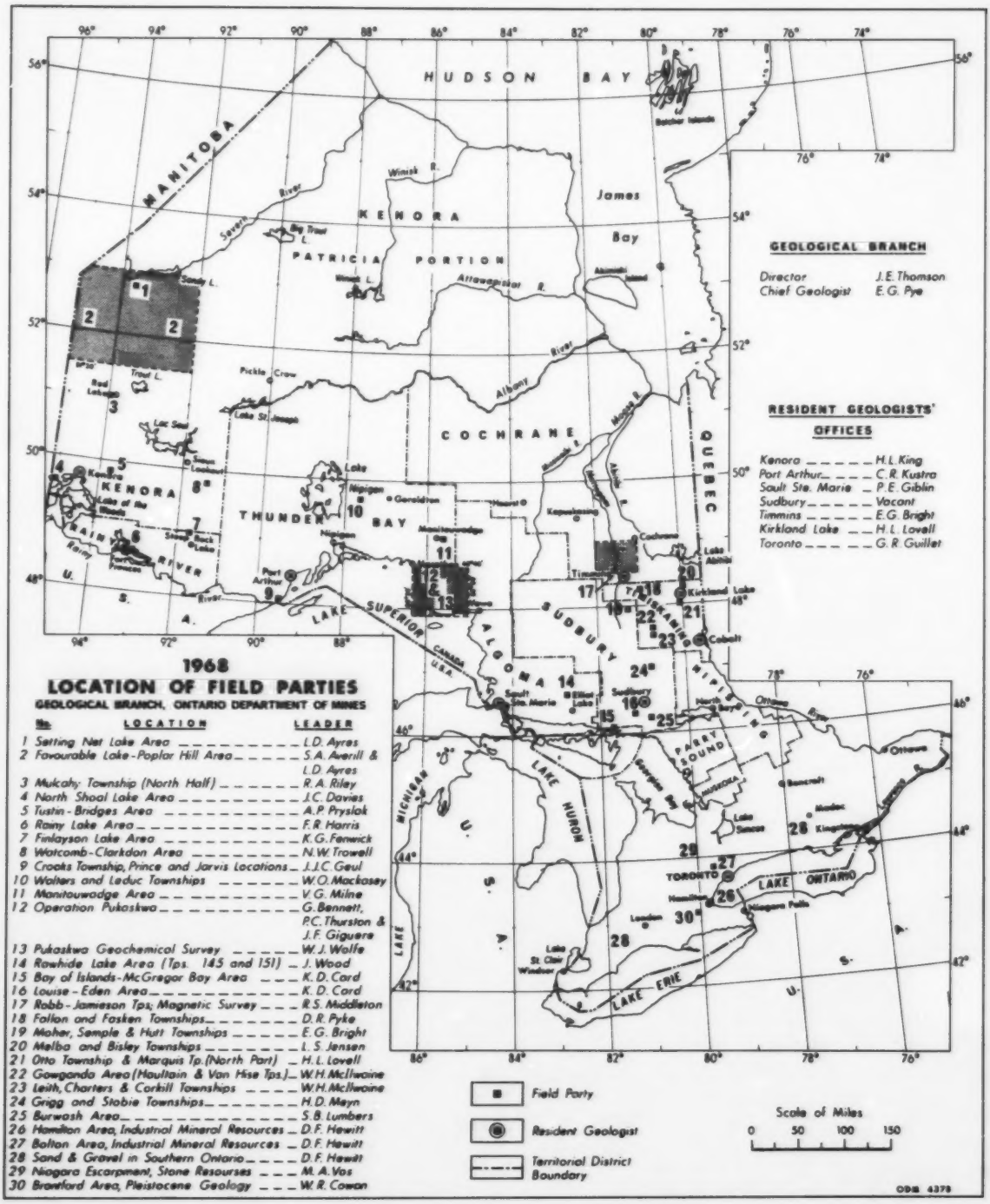
[1] Chief Geologist, Geological Branch, Ontario Department of Mines, Parliament Buildings, Toronto.



1968
LOCATION OF FIELD PARTIES
GEOLOGICAL BRANCH, ONTARIO DEPARTMENT OF MINES

No.	LOCATION	LEADER
1	Setting Net Lake Area	L.D. Ayres
2	Favourable Lake-Poplar Hill Area	S.A. Averill & L.D. Ayres
3	Mulcahy Township (North Half)	R.A. Riley
4	North Shoal Lake Area	J.C. Davies
5	Tustin-Bridges Area	A.P. Pryslak
6	Rainy Lake Area	F.R. Harris
7	Finlayson Lake Area	K.G. Fenwick
8	Watcomb-Clarkdon Area	N.W. Trowell
9	Crooks Township, Prince and Jarvis Locations	J.J.C. Geul
10	Walters and Leduc Townships	W.O. Mackasey
11	Manitouwadge Area	V.G. Milne
12	Operation Pukaskwa	G. Bennett, P.C. Thurston & J.F. Giguere
13	Pukaskwa Geochemical Survey	W.J. Wolfe
14	Rawhide Lake Area (Tps. 145 and 151)	J. Wood
15	Bay of Islands-McGregor Bay Area	K.D. Card
16	Louise-Eden Area	K.D. Card
17	Robb-Jamieson Tps; Magnetic Survey	R.S. Middleton
18	Fallon and Fasken Townships	D.R. Pyke
19	Maher, Semple & Hutt Townships	E.G. Bright
20	Melba and Bisley Townships	L.S. Jensen
21	Otto Township & Marquis Tp. (North Part)	H.L. Lovell
22	Gowganda Area (Haultain & Van Hise Tps.)	W.H. McIlwaine
23	Leith, Charters & Corbill Townships	W.H. McIlwaine
24	Grigg and Stobie Townships	H.D. Mayn
25	Burwash Area	S.B. Lumbers
26	Hamilton Area, Industrial Mineral Resources	D.F. Hewitt
27	Bolton Area, Industrial Mineral Resources	D.F. Hewitt
28	Sand & Gravel in Southern Ontario	D.F. Hewitt
29	Niagara Escarpment, Stone Resources	M.A. Vos
30	Brantford Area, Pleistocene Geology	W.R. Cowan

No. 1 SETTING NET LAKE AREA

DISTRICT OF KENORA (PATRICIA PORTION)

by

L. D. Ayres[1]

Location: The map-area is in the eastern part of the Favourable Lake metavolcanic-metasedimentary belt in northwestern Ontario, 120 miles north of Red Lake, and is bounded by latitudes 52°41' and 52°51' and by longitudes 93°34' and 93°45'. Access is by float-equipped plane from Red Lake.

Mineral Exploration: Mineral exploration of the Favourable Lake belt began in 1927, and the belt is now known to contain deposits of gold, silver, lead, zinc, copper, iron, molybdenum, asbestos, and radioactive-element mineralization; an anomalous feature of the belt is the high silver:gold ratio in many precious metal occurrences of at least 40:1.

The Berens River Mine, now owned by Golsil Mines Limited, is in the northern part of the area and from 1939 to 1948 produced 157,341 ounces of gold, 5,676,486 ounces of silver, 6,105,872 pounds of lead, and 1,797,091 pounds of zinc from 560,707 tons of ore; value of the production was $9,479,694.[2] Golsil Mines acquired the property in 1959 and has carried out an extensive surface and underground diamond drilling program; underground exploration was resumed in September 1968 after an 18-month halt.

An extensive zone of radioactive anomalies occurs south and west of Setting Net Lake and will be mapped in 1969. Most of the anomalies are held by the Keevil Mining Group, under option from CAM Mines Limited, and during the field season an airborne radioactivity survey was carried out. Other surveys, diamond drilling, and trenching were carried out by CAM Mines in 1967. Flint Rock Mines Limited did diamond drilling on six claims which it holds near the centre of the Keevil property.

Many old showings which had been opened by trenching were found north and east of Setting Net Lake.

General Geology: Previous work[3,4] immediately north of the map-area outlined a 2- to 4-mile wide, east-southeast-trending, Early Precambrian, metavolcanic-metasedimentary-metagabbroic belt which is bordered by composite granitic batholiths. The belt extends into the map-area, but the southern contact abruptly changes in trend to south-southeast so that the belt is at least seven miles wide between Setting Net and Northwind Lakes. In the northern part of the area a 1000-foot wide, metasedimentary screen trends

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1 Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.
2 Statistical Files, Ontario Department of Mines.
3 Ayres, L.D., 1967: Preliminary Map P.422, Ontario Department of Mines.
4 Hurst, M.E., 1929: Geology of the area between Favourable Lake and Sandy Lake, District of Kenora; Ontario Department of Mines, Vol. 38, pt. 2, p. 49-84.

west-southwest from the belt into the granitic batholith and may extend as far as Favourable Lake. Preliminary work has shown that a narrow, west-northwest-trending, migmatitic, metavolcanic-metasedimentary belt, with which are associated many radioactive anomalies, occurs south of Setting Net Lake and may extend from North Spirit to Favourable Lakes. The belt is separated from the larger belt by 1 1/2 miles of granitic rocks and is as much as 1 mile wide.

The metavolcanic-metasedimentary sequence is at least 10,000 feet thick. Pillowed to massive mafic flows predominate, especially in the southern part of the area, but felsic flows and pyroclastic rocks are locally abundant. North of Setting Net Lake felsic to locally intermediate tuff, lapillituff, tuff-breccia, and rare flows form a lens which is 4 miles long and as much as 4500 feet thick; the lens is truncated at both ends by faults. Veins mined by Berens River Mines Limited and currently being explored by Golsil Mines Limited occur within, and near the top of this unit. Immediately south of Setting Net Creek, at the east boundary of the area, a sequence of porphyritic felsic flows is at least 2000 feet thick. Felsic metavolcanics elsewhere generally form thin units between mafic flows.

Metasediments form about twenty percent of the sequence and are most abundant in the western part of the belt where a greywacke unit is at least 1000 feet thick. Metasedimentary units elsewhere are generally less than 300 feet thick and are interlayered with mafic flows; most of these units appear to be volcaniclastic greywacke. Minor metasedimentary units within the sequence include conglomerate, slate, chert, ferruginous chert, iron formation, and marble. On the Golsil Mines' property a thin greywacke and conglomerate unit unconformably overlies the major felsic pyroclastic unit.

Sills, dikes, and irregular bodies of metamorphosed gabbro and diorite have intruded the metavolcanic-metasedimentary sequence and underlie 5 to 10 percent of the belt. They are most abundant north of Setting Net Lake. Several peridotite dike swarms which intrude metagabbro were found near Setting Net Lake and are responsible for the aeromagnetic anomalies which occur over the lake. The dikes range in width from a few feet to several hundred feet and appear to be relatively unaltered; their age relationship to the granitic rocks is not known.

Grade of metamorphism ranges from upper greenschist to almandine amphibolite and hornblende hornfels; the higher grade rocks are adjacent to the granitic stocks and batholith. Metamorphic differentiation locally formed a gneissosity, which resembles bedding, in mafic metavolcanics near the granitic intrusions.

The belt has been intruded by two granitic stocks and by a composite, granitic batholith. The smaller stock, about 1/7 square mile in area, is north of Setting Net Lake and is composed of fine-grained, porphyritic trondhjemite. The larger, and probably younger stock underlies an area of about 5 square miles east of Setting Net Lake and is predominantly porphyritic to equigranular granodiorite and quartz monzonite.

The batholith forms the southwestern edge of the belt and is divided into two lobes by the metasedimentary screen in the northern part of the area. The northern lobe is a large stock of relatively uniform,

porphyritic granodiorite and quartz monzonite; the southern lobe is a composite of five intrusive units, which form both discrete plutons and widespread dike swarms. Large mafic metavolcanic and metasedimentary inclusions are common.

Two, north-trending diabase dikes are the youngest rocks exposed.

Structural Geology: The metavolcanic-metasedimentary sequence has been isoclinally folded: fold axes generally trend south to southeast parallel to the boundaries of the belt but east-trending cross folds are locally present.

Five, major, north-trending faults which generally have right hand strike separation occur within the belt and adjacent granitic rocks; the largest fault has displaced the southern contact of the belt about three miles. Two major, east-trending faults also occur within the belt. Minor faults and shear zones are found in many outcrops.

Economic Geology: Narrow, concordant to discordant quartz veins with trace amounts of sulphides occur in all rock types, but, at the present time, economically important veins occur only in the upper part of the major felsic, pyroclastic unit. The economically important deposits are granular, east-trending veins and stockworks containing narrow veinlets, patches, and disseminations of galena, sphalerite, silver-bearing minerals, gold, and rarely chalcopyrite. Fifteen major and innumerable minor veins of this type have been found on the property of Golsil Mines Limited who are currently exploring three closely spaced veins (Nos. 3, 10, and 19); almost all of the production of the former Berens River Mine came from the No. 1 vein, about 2000 feet south of the present exploration target. As of February 1968, drill indicated ore in the Nos. 3, 10, and 19 veins between surface and 1000 feet is 600,000 tons grading 0.18 ounces gold and 7.8. ounces silver per ton, 2.06 percent lead, and 2.99 percent zinc; the ore zone is 1200 feet long.[1]

Forty grab samples collected by the author and his assistants from quartz veins elsewhere contained only traces of gold and silver except for the following three veins. 1. A 6-inch wide, north-trending quartz vein within a shear zone in metagabbro 4500 feet southwest of the old Berens River Mine shaft. The vein has been opened by an old pit, and two grab samples collected by the author were assayed by the Laboratory Branch, Ontario Department of Mines, and were found to contain 0.44 and 0.98 ounces of gold per ton. This may be the Zione vein described by Hurst.[2] 2. Concordant quartz veins within sheared, chalcopyrite-bearing, mafic metavolcanics one mile east of the outlet of Setting Net Lake; the chalcopyrite-bearing zone is at least 50 feet wide. Grab samples collected from two veins by the author's assistant were found by the Laboratory Branch to contain 0.02 to 0.13 ounces of gold per ton and 1.17 to 3.02 percent copper. A grab sample from the sheared mafic metavolcanics was found to contain 0.20 percent copper. 3. An irregular quartz pod within mafic metavolcanics on the west side of the Golsil property. A grab sample

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[1] Golsil Mines Limited, 1967 Annual Report.
[2] Hurst, M.E., op. cit., p. 82.

collected by the author from here gave upon assay 0.04 ounces of gold per ton.

Besides those in quartz veins, there are six major types of sulphide mineral concentrations: 1. disseminated to rarely massive pyrrhotite and pyrite in metagabbro on the west side of the Golsil property and at the northeast end of Setting Net Lake; 2. disseminated pyrite in the major felsic pyroclastic unit on the Golsil property; 3. veins, lenses, and disseminations of pyrrhotite and minor pyrite in volcaniclastic greywacke units which are interbedded with mafic flows near Setting Net Lake; 4. veins and locally disseminations of pyrite, pyrrhotite, and minor chalcopyrite in mafic metavolcanics at the northeast end of Setting Net Lake; 5. syngenetic pyrrhotite and locally pyrite beds within argillite, chert, and marble on the Golsil property and east of Setting Net Lake; and 6. molybdenite and pyrite veins in shear zones in porphyritic granodiorite and quartz monzonite at the north end of the stock east of Setting Net Lake. Grab samples collected by the author and his assistants from the first five types gave upon assay only traces of gold, silver, and copper except for several occurrences of type No. 4 where low copper assays (about 0.1 percent) were obtained.

No assays are available from the molybdenite occurrence but the area warrants investigation. This part of the stock is poorly exposed, but molybdenite-bearing shear zones were found throughout a 3/4 square mile area. Grab samples from the veins are visually estimated to contain between 0.5 and 5 percent molybdenite and the spacing between veins ranges from a few inches to several tens of feet. Pyrite and locally molybdenite and chalcopyrite are also disseminated through the rock between the shear zones.

A 400-foot thick, metamorphosed iron formation unit on the south side of Setting Net Creek contains several 50-foot thick sections which are estimated to be 40 to 50 percent magnetite layers; the magnetite is interbedded with chert and its average grain size is about 0.2 millimetres.

No. 2 FAVOURABLE LAKE - POPLAR HILL AREA

DISTRICT OF KENORA (PATRICIA PORTION)

by

S. A. Averill[1] and L. D. Ayres[2]

Introduction: In 1968, a 2-year, reconnaissance mapping program was initiated in the region bounded by latitudes 51°30' and 53°00' and by longitude 92°00' and the Manitoba boundary. Field work is being confined to selected areas such as metavolcanic-metasedimentary belts, mafic intrusions, aeromagnetic anomalies, and areas where air photograph interpretation suggests investigation is warranted. During the field season

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[1] Undergraduate student, University of Manitoba, Winnipeg, Man.
[2] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

four metavolcanic-metasedimentary belts in the western part of the region were examined by the senior author. These belts are in the (1) Mackay - Cherrington Lakes area, (2) Favourable Lake area, (3) McInnes Lake area, and (4) Hornby - Findlay - Hampton Lakes area.

Mineral Exploration: Except in the Favourable Lake area where exploration has been carried out intermittently since 1927, records of mineral exploration are scanty. There is no record of exploration in the Mackay - Cherrington Lakes area, but several small pits were found on sulphide-mineral-rich zones. In the McInnes Lake area, known mineral exploration consists of 12 diamond drillholes bored by Phelps Dodge Corporation of Canada Limited in 1962 to test geophysical anomalies. In the Hornby - Findlay Lakes area Asbestos Corporation (Explorations) Limited has been engaged in prospecting, trenching, geophysical, and geological surveys since 1967 on a large group of claims and have discovered two extensive mineralized zones.

Recent exploration in the Favourable Lake area has been for silver and uranium. Two silver properties have been tested by diamond drilling: one property, which is currently held by Barymin Explorations Limited under option from Noranda Mines Limited, is on Borland (Beatrice) Lake; the other property is on the north side of the west arm of Favourable Lake and is held by North Rock Explorations Limited. Since 1967 several companies including CAM Mines Limited, the Keevil Mining Group, Conwest Exploration Company Limited, Flint Rock Mines Limited, and Favourable Mines Limited have been actively engaged in uranium exploration within a zone of migmatitic metasediments southeast of Favourable Lake.

General Geology and Structural Geology:

1. Mackay - Cherrington Lakes area: An 8-mile long, northwest-trending, metavolcanic belt, composed entirely of massive to pillowed mafic flows, occurs between Mackay and Cherrington Lakes; its average width is 1 mile and maximum width is 3 miles. The belt was previously mapped by Rickaby[1] and Kirwan[2] and the outlines of the belt are generally as shown by Kirwan except that at its northwest end the belt is wider than previously shown. Mafic metavolcanics mapped by Kirwan between Palsen and Mackay Lakes were not examined. The belt appears to be a synclinal structure.

2. Favourable Lake area: The west- to northwest-trending metavolcanic-metasedimentary belt in this area was mapped for a strike-length of 22 miles and is the central part of a long belt, the eastern part of which was mapped by Hurst[3] and is currently being remapped in detail by the junior author (No. 1, this report); the northwestern part was previously mapped by Quinn[4] and Bennett and Riley[5]. An 8-mile long segment of the belt northwest of Favourable Lake had not been previously mapped. The belt ranges in width from 1 1/2 miles at the east and northwest ends of Favourable Lake to 4 miles at latitude 53°00', longitude 94°15'. Migmatite and hybrid granite

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1 Rickaby, H.C., 1923: Ontario Dept. Mines, Vol. 32, pt. 2, p. 49-59.
2 Kirwan, L.D., 1959: Geol. Surv. Canada, Map 26-1958.
3 Hurst, M.E., 1929: Ontario Dept. Mines, Vol. 38, pt. 2, p. 49-84.
4 Quinn, H.A., 1960: Geol. Surv. Canada, Map 26-1960.
5 Bennett, G. and Riley, R.A., 1967: Ontario Dept. Mines, Prel. Map P.430.

mapped by Bennett and Riley[1] on the Varveclay Lake sheet between two arms of the belt at this locality were found to be greywacke and felsic tuff. The north boundary of the belt on this sheet should extend from the north arm of their belt along the west-northwest-trending creek to cross latitude 53°00' at longitude 94°05'. Preliminary work east-southeast of Favourable Lake suggests that a narrow, migmatitic, metavolcanic-metasedimentary belt extends from the south end of Favourable Lake to North Spirit Lake.

Mafic flows and felsic tuff form most of the metavolcanic-metasedimentary belt near Favourable Lake while greywacke predominates northwest of the lake. Near the centre of Favourable Lake two lenses of slate and argillite, each at least 1000 feet thick and 3 miles long, occur within mafic metavolcanics. Minor rock units in the belt are marble, conglomerate, iron formation, metagabbro, feldspar porphyry, and tourmaline-bearing pegmatite.

The belt appears to be an anticline. Faults are numerous and are generally parallel to lithologic boundaries. A major fault trends east-southeast from the south part of Favourable Lake along the narrow, migmatitic, metavolcanic-metasedimentary belt.

3. McInnes Lake area: McInnes Lake occupies the axis of a 28-mile long, north-trending metavolcanic belt which has a maximum width of 4 miles. The belt was previously mapped by Donaldson[2] and the outline of the belt was only slightly modified during the present survey. The rocks which Donaldson showed to be metasediments, were found to be felsic to intermediate tuff, lapilli-tuff, and tuff-breccia. Greywacke is locally present but appears to be reworked pyroclastic material. Mafic metavolcanics are less extensive than previously shown and are most abundant in the north part of the belt. Minor rock units include two iron formation units as much as 100 feet thick in the southern part of the belt; metagabbro and peridotite dikes and sills as much as 12 miles long on the east side of the lake; and tourmaline-bearing pegmatite which is most abundant in the northern part of the belt. Fold structure could not be determined and no major faults were recognized.

4. Hornby-Findlay-Hampton Lakes area: A 13-mile long, metavolcanic-metasedimentary belt which trends northward through Hornby and the western part of Findlay Lakes is composed predominantly of mafic flows with some greywacke and felsic tuff on the east side; the belt has a maximum width of six miles. The belt is narrower than shown by Donaldson[2] because metasediments previously mapped in the eastern part of Findlay and northern part of Hampton Lakes are migmatites in which granitic rocks predominate. Another major change was made south of Hornby and north of Findlay Lakes where rocks previously mapped as metasediments[2] were found to be mafic metavolcanics. Minor rock units within the belt include iron formation, metagabbro, and peridotite.

A large magnetic anomaly on aeromagnetic map 857G southeast of Hampton Lake was found to be caused by diorite or syenodiorite. This anomaly is part of a 16-mile long, north-northwest-trending anomaly (maps 866G, 867G) which may

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[1] Bennett, G. and Riley, R.A., op. cit.
[2] Donaldson, J.A., 1961; Geol. Surv. Canada, Map 50-1960.

reflect a large, intermediate to mafic intrusion. At Matchett Lake near the centre of the anomaly, porphyritic granodiorite was found.

The fold pattern appears to be complex but could not be deciphered. Faults are numerous and generally trend either north or east.

Economic Geology:

1. Mackay-Cherrington Lakes area: two types of mineralization were found in this belt: (a) disseminated pyrrhotite and pyrite within silicified shear zones in mafic metavolcanics and (b) trace amounts of molybdenite in pegmatite and feldspar porphyry dikes. Mineralized shear zones were found on both Mackay and Cherrington Lakes, are as much as 50 feet wide, and contain up to 20 percent sulphide minerals. Grab samples collected by the senior author gave upon assay only trace amounts of economically important elements.

2. Favourable Lake area: The major showing is the silver property currently held by Barymin Explorations Limited on Borland (Beatrice) Lake. Diamond drilling by previous owners had outlined a 1200-foot long, east-trending zone which contains 238,000 tons averaging 9.0 ounces of silver per ton (Northern Miner, 18 August 1966). The zone is generally 5 to 10 feet wide although widths of up to 65 feet have been encountered; most of the zone is beneath the lake. Mineralization consists of sparse galena and unidentified silver minerals and occurs in a silicified zone within greywacke which contains marble interbeds. In some ore grade sections no visible mineralization can be observed, and prospecting for similar showings elsewhere will be difficult. The silver showing held by North Rock Explorations Limited is four miles east-southeast of the Barymin showing and consists of several concordant to slightly discordant quartz veins in felsic and locally mafic tuff. The veins are up to eight inches wide and contain disseminated to massive galena and minor pyrite, chalcopyrite, and sphalerite. Three grab samples collected by the junior author from the vein gave upon assay by the Laboratory Branch, Ontario Department of Mines, 7.30, 19.49, and 28.59 ounces of silver per ton.

On Favourable Lake, shear zones in felsic tuff locally contain disseminated to massive pyrite and pyrrhotite, and minor chalcopyrite. A grab sample collected by the senior author from one zone gave upon assay by the Laboratory Branch 1.24 ounces of silver per ton and traces of copper, lead, and zinc. Disseminated to massive pyrite and pyrrhotite occur at many other places along the belt.

3. McInnes Lake area: Sulphide mineralization was only rarely observed and consists mainly of silicified shear zones containing sparse pyrite. Geophysical anomalies drilled in 1962 by Phelps Dodge Corporation of Canada Limited on the east shore of the southern part of the lake were caused by ferruginous chert and iron formation which contain pyrite and pyrrhotite layers. Prospecting is hampered by poor exposure inland where all outcrops have a thick blanket of moss.

4. Hornby-Findlay-Hampton Lakes area: In 1967 Asbestos Corporation (Explorations) Limited discovered two, north-trending, mineralized shear zones in mafic metavolcanics west and northwest of Findlay Lake. Both zones are about three miles long and contain disseminated to massive pyrrhotite and

disseminated chalcopyrite. The southern zone is at least 105 feet wide and has been opened by 16 trenches (to 20 August); only minor work has been done on the northern zone. Smaller, subparallel, subsidiary, mineralized zones occur near the main zones. A narrow, northwest-trending shear zone in mafic metavolcanics north of Hornby Lake is held by E. Gay and has been opened by three trenches. The shear zone contains up to 30 percent pyrite and pyrrhotite and minor chalcopyrite. No assays are available from this area.

No. 3 MULCAHY TOWNSHIP (NORTH HALF)

DISTRICT OF KENORA (PATRICIA PORTION)

by

R. A. Riley[1]

Location: Mulcahy Township lies at the western end of the Red Lake metavolcanic-metasedimentary belt; its centre situated about 19 air miles west-southwest of the town of Red Lake.

Mineral Exploration: Prior to 1956 the map-area received only sporadic attention and exploration was confined almost entirely to surface prospecting for gold. In 1956 Cochenour Willans Gold Mines Limited acquired mineral rights for most of the northeast part of the township and subsequent exploration indicated two zones of copper-nickel mineralization. In 1962 Falconbridge Nickel Mines Limited optioned the property but the ensuing exploration program indicated only limited tonnages of low grade material. Since 1963 Cochenour Willans has carried out a systematic and detailed exploration program on the property which in 1967 resulted in the discovery of a small, high grade base metal deposit.

In 1961 Newconex Canadian Exploration Limited carried out a program of geological mapping, geophysical surveying, and diamond drilling on a block of 18 claims between Douglas Lake and the eastern township boundary.

General Geology: Metavolcanic and metasedimentary rocks form an arcuate structure trending southeast from the Folley Lake-Trout Bay area to Johnson Lake and thence westerly through Hatchet Lake (see O.D.M. Map 49a). The rocks on the northeast limb of this structure consist, progressing northeast and in order of decreasing age, of basalt; interbedded greywacke, argillite, and cherty iron formation; mafic pyroclastics and basalt; intermediate pyroclastics and intercalated intermediate and mafic flows; and chert, iron formation, greywacke, and argillite. This sequence has been intruded by several metagabbro sills, at least two of which show compositional differences resulting from magmatic differentiation.

The rocks on the south limb of the arcuate structure consist of amphibolite (recrystallized basalt) and minor metagabbro, iron formation, and metasedimentary rocks intruded by granitic and hybrid granitic rocks.

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[1] Resident Geologist, Ontario Dept. of Mines, Red Lake, Ontario.

Granitic rocks in the vicinity of Douglas Lake and south of Leitch and Hatchet Lakes are massive to foliated and biotite-bearing; those along the eastern township boundary are massive hornblende-bearing varieties. Along the south limb of the arcuate structure all gradations between the "typical granites" described above and hybrid varieties are present.

Feldspar porphyry dikes cut the rocks of the "greenstone" complex, several types and ages of granitic dikes are found within the granitic batholiths, and narrow, fine-grained mafic dikes cut granitic rocks on the shore of the central part of Douglas Lake.

Structural Geology: The rocks on the northeast limb of the arcuate "greenstone" complex form the southwest limb of a northwest-trending syncline.

A prominent mylonite zone, marked by brecciation, a network of quartz veins and stringers, and altered granitic rocks, extends northwest from the south shore of Leitch Lake to the township line immediately south of Hatchet Lake. Smaller mylonite zones, trending in various directions, occur elsewhere within the granitic batholiths. A set of east-west trending faults and a subordinate, poorly defined set of northwest-trending faults are found within the "greenstone" complex.

Economic Geology: Pyrrhotite, pyrite, and locally traces of chalcopyrite and sphalerite are present as disseminations and lenticles in black argillite and some metagreywacke units.

Iron formation south of Trout Bay and south and southwest of Muskrat Bay contains pyrrhotite, pyrite, and small amounts of chalcopyrite and sphalerite. Chalcopyrite and sphalerite occur most commonly along bedding planes. Selected grab samples collected from trenches in this unit were found by the Laboratory Branch, Ontario Dept. of Mines, to contain up to 0.12% Zn and 1.55% Cu. Iron formation elsewhere in the map-area usually contains small amounts of sulphide mineralization.

Pyrrhotite, pentlandite, and chalcopyrite are disseminated in the basal section of a metagabbro sill located along the southeast shore of Fahlgren Lake. Thicknesses vary from a few inches to 10 feet for a strike length of over 2000 feet. Kuryliw[1] gives assays for this zone ranging from 0.23% to 0.55% Ni and trace to 0.60% Cu.

Disseminated copper-nickel mineralization lies within a sheared antigorite-tremolite schist, the altered phase of a metagabbro, found as a narrow zone along the upper contact of an iron formation unit and traced intermittently from Johnson Lake northwest to the township boundary. Mineralization consists of pyrrhotite, pentlandite (altered to violarite near surface) and chalcopyrite (Kuryliw)[1]. The best zone, about 400 feet long, up to 30 feet thick, and located about 3800 feet south southwest of the south end of Trout Bay, has an approximate grade of 0.50% Ni and 0.25% Cu (Saukko)[2].

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[1] Kuryliw, C.J., 1963: The geology of the Trout Bay nickel deposits, Red Lake District, Northwestern Ontario; Unpub. M.Sc. Thesis, Univ. of Manitoba.

[2] Saukko, R.N., 1962: Report on Trout Bay Option, Mulcahy-Ball Townships, Red Lake District; unpub. report, Falconbridge Nickel Mines Ltd.,

Within other metagabbro sills scattered small occurrences of disseminated pyrrhotite carrying minor values in copper and silver are present.

A small, shallow deposit of massive pyrrhotite, sphalerite, and chalcopyrite and minor galena and marcasite is located immediately south of a small lake 4000 feet south-southwest of the south end of Trout Bay. Found in two zones about 800 feet apart on either side of an east-west fault, the mineralization appears to be filling dilation zones on the noses of fault-associated drag folds in metasediments intruded by gabbro, and has in part replaced greywacke and quartzite. The western body on the south side of the fault contains 16,500 tons averaging 0.68% Cu and 4.57% Zn while in the eastern zone 130,500 tons grading 1.85% Cu and 6.90% Zn have been outlined. Significant values in silver and lead are also present.[1]

Molybdenite is widely disseminated over a strike length of 2000 feet in a sugary-textured white to pink aplitic rock found a few hundred feet south of the southwest side of the Hatchet Lake narrows. This material usually yields trace amounts of Mo upon assay but two selected grab samples were found by the Laboratory Branch to contain 3.25% and 0.13% Mo.

Cherty iron formation lying stratigraphically below the antigorite-tremolite schist reaches thicknesses of up to 60 feet at the north end of the small lake 4,000 feet south-southwest of the south end of Trout Bay. Kuryliw[2] reports assays of from 29.6% to 37.7% Fe from drill intersections in an area 1200 feet east of the above small lake.

No. 4 NORTH SHOAL LAKE AREA

DISTRICT OF KENORA

by

J. C. Davies[3]

Location: The map-area, bounded on the west by the Province of Manitoba, on the east by longitude 94°52'30" West, and on the north and south by latitudes 49°37'30" North and 49°30'00" North respectively, embraces most of the northern two-thirds of Shaol Lake. The area is about 30 miles southwest of Kenora.

Mineral Exploration: Considerable exploration was undertaken following the discovery of a high grade gold deposit south of Bag Bay in 1893. Production of gold from three mines has been discontinuous, with a combined official value of over three-quarters of a million dollars. Additional drilling of the past producers and of a number of other deposits has taken place from time to time.

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[1] Hutton, D.A., Chief Geologist, Cochenour Willans Gold Mines Ltd., personal communication.

[2] Kuryliw, C.J., op. cit.

[3] Geologist, Ontario Department of Mines, 203 Main Street South, Kenora, Ontario.

A number of companies have been involved in the search for base metals during the past five years in parts of the area. In the summer of 1968 one geophysical anomaly was drilled.

General Geology: The early Precambrian rocks of the area are predominantly volcanic and are part of the type-Keewatin section outlined by Lawson[1]. Within the map-area the rocks trend east to northeast as indicated by Greer[2].

A lower zone of mafic flows with minor fragmentals, followed by a central zone of intermediate to felsic fragmentals and an upper zone of mafic to intermediate flows and fragmentals, are exposed in the northwest half of the area. A narrow band of metasediments is found in the upper zone. The total thickness is difficult to establish because complex folding around the nose of a granitic intrusion to the southwest dies out in a number of broad shears in the central zone.

In the southeast half of the area the rock units are more intimately interlayered, and their continuity is more difficult to establish because of the large area of lake. Metasedimentary rocks and felsic metavolcanic rocks are quantitatively more important here. Goodwin[3] has estimated that the composite stratigraphic sequence in the whole area has a thickness of about 23,000 feet.

Mafic to ultramafic sills are largely confined to the lower zone of mafic flows. These are mostly amphibole-rich, but some contain pyroxene and serpentinized olivine at the stratigraphic bottom. A biotite-rich ultramafic rock occurs as irregularly-shaped bodies, particularly in the northwest corner of the area.

Granitic intrusions are mostly elliptical in plan with well defined contacts and few inclusions. Near the southeast corner of the area, however, a complex of quartz and feldspar porphyries and inclusion-laden granodiorite cuts the metavolcanic and metasedimentary rocks.

A diabase dike occurs in the vicinity of Snowshoe Bay.

Structural Geology: A major anticlinal axis occurs diagonally through the central part of the area. It is flanked to the northwest by a synclinal axis and to the southeast by several closely spaced fold axes. Cross-folding in the west central and southeast parts of the area has complicated the structural interpretation.

Faulting and shearing have taken place in a number of directions. In the vicinity of Bag Bay and Helldiver Bay the northeast-striking rock units have been displaced by a series of right-handed faults striking close to east-west. There has been some subsequent movement along left-handed faults striking northeast.

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1 Lawson, A.C., 1885: Geol. Surv. Canada, Ann. Rept., Vol. 1, pt. CC.
2 Greer, Leonard, 1930: Ontario Dept. Mines, Vol. 39, pt. 3, p. 42-56.
3 Goodwin, A.M., 1965: Ontario Dept. Mines, Prelim. Rept. 1965-2.

Small mafic dikes commonly occur in fractures striking north to north-northwest, along which both right and left lateral displacement has been determined.

Kink folds occur in a number of localities in the area. At least two periods of deformation have taken place.

Economic Geology: Most of the known gold deposits in the area are associated with pyrite in quartz and quartz-carbonate veins. Some of these in the Bag Bay-Helldiver Bay area trend west to west-northwest and are apparently related to a known fracture system. These are in general small. The strongest veins trend northwest, and it is from these that gold was produced at the Mikado, Cedar Island and Olympia Mines. Blocks of potential ore have been outlined at both the Mikado and Cedar Island Mines which should be re-examined when economic factors change.

The Duport Mine on Cameron Island lies within schistose mafic rocks. Here the gold is associated with arsenopyrite[1]. Additional drilling has been done since the closing of operations in 1936, and the gold-bearing zone has been extended.

A point of interest in assessing the base metal potential of the area is the widespread distribution of small amounts of sulphides in the rocks. This is mostly pyrite, but some pyrrhotite and chalcopyrite were noted in places. Sphalerite and galena are present in a number of old gold properties.

The zone of shearing along the west side of the Sirdar Peninsula has been intruded by mafic rocks and in one place chalcopyrite and nickeliferous pyrrhotite was encountered, Most of this zone lies beneath the water, and deserves further attention.

Several small gossans occur on Silver Fox and adjacent islands. The second island southeast of Silver Fox Island contains chalcopyrite and nickeliferous pyrrhotite at the margin of a mafic intrusion.

Rusty weathering coarse mafic rocks occur north and west of Partridge Lake, and, though pyrite and pyrrhotite were the only sulphides recognized, the area should be examined further. The reported occurrence of copper in granitic rocks east of Partridge Lake is of interest.

Minor copper and zinc have been found by Olympia Mines Exploration Limited in the drilling of an anomaly east of Clytie Bay. The anomaly coincides with a north-south lineament.

Fine-grained serpentinized basalt with narrow veins of cross-fibre asbestos occurs on three islands near Machin Point. The faulted extension of this rock unit might be sought to the northeast to determine whether asbestos is present.

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[1] Thomson, Jas. E., 1936: Ontario Dept. Mines, Vol. 45, pt. 3 p. 44-53.

No. 5 TUSTIN-BRIDGES AREA (EAST HALF)

DISTRICT OF KENORA

by

A. P. Pryslak[1]

Location: The area mapped during the 1968 field season comprises the townships of Bridges and Docker which are centred approximately 10 miles west of Vermilion Bay. Highway 17 passes through the centre of the area and the main lines of the the Canadian Pacific Railway cross the south part.

Mineral Exploration: During the winter of 1967-68, Falconbridge Nickel Mines Limited completed an investigation of the Cobble Lake area, for base metal potential, with a drilling program.

During the field season, Noranda Mines Limited continued exploration of their zinc-silver property in Bridges Township with a geophysical survey and further trenching.

Prospecting for uranium in the area has been carried out intermittently since 1948. Numerous occurrences have been investigated by trenching and diamond drilling. During the field season, Coulee Lead and Zinc Mines Limited investigated radioactive anomalies discovered by an aerial radiometric survey conducted over the southern parts of Bridges and Docker Townships and the northeast quarter of Docker Township.

In 1968, Noranda Mines Limited, carried out a detailed program of geological mapping, trenching, and drilling on a 45 claim group, optioned from Coulee Lead and Zinc Mines Limited in the Game Lake area, Bridges Township.

General Geology: An east-west trending belt of metavolcanic-metasedimentary rocks, approximately 3 miles in width, occupies the northern part of the map-area.

The metavolcanic rocks vary in composition from mafic to intermediate and consist mainly of pyroclastic material with minor amounts of massive and pillowed flows.

The metasedimentary rocks, interbanded with the metavolcanic rocks, are predominantly greywacke, but include minor amounts of arkose, quartzite and iron formation. Distinction between intermediate tuff and agglomerate from metasedimentary rocks is difficult.

The grade of metamorphism is in the epidote-amphibolite to amphibolite range.

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[1] Post-graduate student, Department of Geology, University of Manitoba, Winnipeg, Manitoba.

Sills, dikes and irregular bodies of metamorphosed gabbro, peridotite and pyroxenite intrude the metavolcanic-metasedimentary sequence. They are most abundant in the Cobble Lake area, along an east-west zone about one-half mile in width. Two ages of gabbro occur, the earlier phase being well foliated and the later phase being predominantly massive. Distinction between the earlier phase of gabbro and mafic metavolcanic rocks is difficult. The peridotites are highly serpentinized.

Granitic rocks, varying in composition from granite to granodiorite, occupy the southern half and the extreme northern edge of the map-area. The contact between the metavolcanic-metasedimentary belt and the granitic intrusions, ranges from sharp to migmatitic but is approximately concordant.

Several phases of granitic intrusion are evident, and the pegmatites intruding the metavolcanic-metasedimentary belt and the contact zones with the composite batholiths, appear to be related to the later phase.

Structural Geology: Although primary layering is occasionally present in the metavolcanic-metasedimentary rocks, foliation is the dominant structural feature. It invariably conforms with the primary layering.

No major faults or folds have been recognized but minor shears, parallel to layering and foliation, occur in numerous places. In small scale folding, the foliation is involved in the deformation.

Prominent lineaments in the map-area are interpreted as fault zones.

Economic Geology: Concentration of sulphides were found at more than twenty localities. Pyrite and pyrrhotite are the main minerals, generally occurring in shear zones. A speck of malachite was observed at one such occurrence about 1/4 mile west of Game Lake.

The zinc-silver deposit in Bridges Township, investigated by Noranda Mines Limited, is approximately 40 feet in width and 9000 feet in length. It lies about 1/4 mile north of Highway 17, strikes N80°E and dips 60°N. Pyrrhotite, pyrite, sphalerite, galena and magnetite are the predominant minerals of the sheared and partially recrystallized, siliceous iron formation.

Pegmatites occurring as dikes, pods and irregular branching bodies are the host rock for uranium mineralization. Late phase intrusions, such as the granite of the Scotstown quarry and the white granodiorite along the north shore of Cobble Lake, contain radioactivity of 2 to 4 times normal background. Samples submitted to the Laboratory Branch, Ontario Dept. Mines, assayed 0.005% and 0.006% U_3O_8 equivalent.

The radioactivity in pegmatite is due mainly to yellow secondary uranium minerals, occurring along numerous fractures of various orientation. The primary minerals, monazite and uraninite, have also been identified but are not common. The highest radioactive values appear to occur in biotite-rich and apatite-rich phases.

In the Cobble Lake area, an adit has been driven to examine a pegmatite for its mica content. The mica zone strikes east-west, dips vertically and is less than 2 feet in width. It can be traced on surface for a length of about

30 feet. Sheets up to 12 inches in diameter are common but most books contain wedge structure.

The Scotstown granite quarry in Docker Township occurs in a massive to weakly layered, non-foliated, pink granite.

No. 6 RAINY LAKE AREA

DISTRICT OF RAINY RIVER

by

F. R. Harris[1]

Location: The area mapped is bounded by longitudes 93°04'00"W and 93°17'30"W and by latitude 48°47'30"N and the International Boundary. It includes all of Watten Township which is in the Rainy River District.

Mineral Exploration: Copper, iron, and molybdenum have been discovered in the area. Numerous old pits and several shafts, usually on sulphide-bearing iron formation, date back to the turn of the century. The most extensive work of this era was done by the Nickel Lake Mining Company, which sank a 75-foot shaft on the south shore of Nickel Lake about 1918.

In 1956 and 1957 Stanol Mines Limited did trenching, geophysical work, and diamond drilling on an iron property on Reef Point.

In 1957 Stratmat Limited put down 14 diamond drillholes on iron formation and associated sulphides west of Rocky Islet Bay.

In 1958 disseminated chalcopyrite in gabbro was discovered just east of Watten Township, at the eastern end of Grassy Portage Bay. Noranda Mines Limited has done extensive diamond drilling, geophysical surveys, and geological mapping on this and surrounding properties from 1958 to date. A small potential orebody has been outlined.

In 1966 Paramaque Mines Limited did an electromagnetic survey and drilled 5 diamond drillholes on iron formation and associated sulphides in the eastern part of Watten Township just south of Highway 11.

In 1966 and 1967 Messrs. Daly and Galbraith of Fort Frances explored a sulphide zone west of the north end of Nickel Lake by diamond drilling and surface exploration.

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[1] Geologist, Ontario Department of Mines, 179 Algoma Street South, Port Arthur, Ontario.

In 1967 M. Hupchuk of Fort Frances discovered chalcopyrite mineralization just east of the area, between Highway 11 and Grassy Portage Bay. North - 60 Explorers Limited have put down 3 diamond drillholes on this property.

In 1968 Noranda Mines Limited staked additional claims in Watten Township, along the south shore of Grassy Portage Bay and north of Armot Island in Swell Bay.

General Geology: As outlined by Lawson[1], the area consists of Precambrian metasediments and metavolcanics which are intruded by porphyritic quartz monzonite, hornblendite (syenite and basic facies of syenite of Lawson), granite, hornblende gabbro, and diabase dikes. In the Rocky Islet Bay area, metasediments stratigraphically underlie metavolcanics. Lawson's Laurentian granite dome in the Rice Bay area was found to be predominately metasediments cut by about 15 percent granite sills. Hornblende gabbro was found to be more extensive than shown on Lawson's map and two bands of felsic metavolcanics were outlined while mapping.

Structural Geology: Two structural domes (in Rice Bay and north of the International Boundary) occur in the area.

A major east-west fault extends through Macdonald Inlet and a second east-west fault was found south of Grassy Portage Bay.

Economic Geology:

Copper: Three types of copper mineralization have been recognized in the area mapped.

On Noranda's Grassy Portage Bay property, chalcopyrite and pyrrhotite are disseminated through hornblende gabbro close to the contact between the gabbro and mafic metavolcanics.

In several places throughout the area, such as south of Nickel Lake, minor amounts of chalcopyrite occur in massive pyrrhotite and pyrite. The sulphides are usually associated with magnetite iron formation, which they appear to be replacing. This is the most abundant type of sulphide mineralization in Watten Township but the best sample obtained by the author from this type of mineralization was found by the Laboratory Branch, Ontario Dept. Mines to contain 0.5 percent copper.

West of the north end of Nickel Lake, disseminated to massive pyrrhotite and pyrite with minor amounts of chalcopyrite occur in metasediments where they are in contact with a body of gabbro. The zone containing chalcopyrite mineralization is about 15 feet wide and contains about 0.5 percent copper. Similar mineralization was found at two other points along the contact between this gabbro and metavolcanics or metasediments.

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[1] Lawson, Andrew C., 1913: The Archean Geology of Rainy Lake Restudied; Geol. Surv. Canada, Mem. 40 (No. 24, Geol. Ser.).

Iron: Numerous narrow, discontinuous bands of iron formation are exposed in the area and are most abundant on Reef Point and north of Commissioners Bay.

The widest zone encountered on Reef Point was 150 feet of lean iron formation containing an estimated 30-40 percent magnetite. Most of the iron formation contains some sulphides.

Molybdenite: 1,000 feet east of Watten Township on Highway 11, a roadcut of predominately medium-grained white granite has intruded fine-grained biotite-quartz schist and the whole outcrop is cut by a stockwork of quartz veins. Molybdenite occurs in and along the margins of some of the quartz veins and in slips and fractures in the rock.

Molybdenite is also reported to occur on the powerline north of Rocky Islet Bay and along the east side of Rocky Islet Bay.

Suggestions to Prospectors: The most interesting mineralization discovered in this area to date is the disseminated chalcopyrite in hornblende gabbro along the south shore of Grassy Portage Bay. The whole contact between this gabbro and the surrounding metavolcanics and metasediments should be prospected. Induced polarization geophysical methods appear to be most useful in locating this type of mineralization.

Granite in the northeastern part of the map-area should be prospected for molybdenite. The contact between granite and metagreywacke appear to be most favourable.

No. 7 FINLAYSON LAKE AREA

DISTRICT OF RAINY RIVER

by

K. G. Fenwick[1]

Location: The Finlayson Lake area was mapped during the field seasons of 1967 and 1968 and lies in the Rainy River District in northwestern Ontario. The map-area covers approximately 210 square miles; it is bounded by latitudes 48°50' and 49°00'N and longitudes 91°21' and 91°45'W. The area is directly north of the town of Atikokan. The south end of Finlayson Lake is 16 miles by road from Atikokan. The area contains excellent water routes.

Mineral Exploration: In 1928, J.E. Hawley mapped the area southeast of the Finlayson Lake area (O.D.M. Map No. 38e).

In 1937, E.S. Moore (O.D.M. Map No. 48a) and in 1953, the Development Department of the Canadian Pacific Railway (M.W. Bartley - Area Number 4, 1953)

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[1] Geologist, Ontario Department of Mines, 179 South Algoma Street, Port Arthur, Ontario.

did reconnaissance surveys of the map-area.

R.S. Woolverton, in 1951 and 1952, mapped the Lumby Lake area (O.D.M. Map No. 1960g) which ties on to the northeast corner of the map-area.

R. Shklanka, in 1964 and 1965, mapped the Steeprock Lake area (O.D.M. Map No. P.348) which is directly south of Finlayson Lake.

Burrex Mines Limited has 31 claims northwest of Sawbill Bay. In 1965 and 1966, the company did geological and self potential surveys of their claims.

In 1966 and 1967, Cyprus Exploration Corporation Limited (K. Kuhner's property) conducted electromagnetic and magnetometer surveys and drilled twelve holes (5,443 feet) on 36 claims in the central part of Finlayson Lake to test 8 conductors.

Canadian Addicks Mining Corporation's property consistsof 34 claims at the north end of Finlayson Lake (north of Raft Lake). In 1966, they conducted electromagnetic and magnetometer surveys and outlined nine conductors. Thirty trenches have been blasted.

Michael Wicheruk, prospector, has 29 claims in the vicinity of Copper Hook Lake and has done some trenching and stripping.

General Geology: All the bedrock in the map-area is of Precambrian age. Finlayson Lake is underlain by metavolcanics and metasediments that form a narrow belt, which is approximately 15 miles long and varies in width from 1/2 to 3 1/2 miles. The south and west parts of this belt were mapped during the 1967 field season and the north and east parts were mapped in 1968.

The metasediments consist of conglomerate, impure quartzite, argillite, greywacke, slate, and their derived schists. These metasediments are found mainly intercalated with the metavolcanics.

The metavolcanics, which are predominantly mafic to intermediate lavas and amphibolites on the west, intermediate and pillow lavas in the centre, and tuffs and mafic lavas on the east, dominate the metavolcanic-metasedimentary belt.

The granitic rocks, enclosing the east side of the metavolcanic-metasedimentary belt, are granodiorite, quartz porphyry, and quartz-sericite schist. The contact zone is a complex of basalt, quartz porphyry and diorite.

Biotite and hornblende granite, granite gneiss and feldspar porphyry are the principal igneous rocks on the west side of the belt.

Diabase and lamprophyre dikes intrude the metavolcanics and metasediments.

Pleistocene deposits consist of till, gravel, sand and varved clays.

Structural Geology: The metavolcanic-metasedimentary belt trends northeasterly down Finlayson Lake. Top determinations based on grain gradations and pillow lavas indicate that the belt is a syncline and is isoclinally folded.

Two distinct schistosities were noted - one closely parallel to the strike of the rocks and one trending approximately N45°E and dipping steeply.

Several prominent northeast-trending lineaments were noted in the area. Pronounced shearing, quartz veining, and carbonatization are characteristic of the rock adjacent to these lineaments.

Economic Geology

Gold: Prospecting for gold within the area has been carried on since the 1890's. The shafts of five gold mines (Golden Winner, Hammond Reef, Jack Lake, Upper Seine, Plater-Gralouise) were noted in the Marmion Lake area. At these mines the gold was found in quartz veins in granodiorite in shear zones. None was a big producer - the most productive mine, the Hammond Reef yielded gold worth $3,857.[1]

Molybdenum: A molybdenite occurrence was noted on the east bay of Eye Lake. A grab sample taken by the author was found by the Laboratory Branch, Ontario Department of Mines, to contain 0.42 percent molybdenum. The molybdenite is found in sheared granite and quartz near the contact between the metavolcanics and the granitic rocks. An adit (102 feet long) is in the area. The molybdenite was found erratically disseminated in the shear zone (approximately 15 feet wide) but high grade samples were uncovered in the dump of the adit.

Sulphides: The Kuhner deposit is a tabular body having a strike of N30°E and a vertical to nearly vertical dip. Development work has indicated erratic sulphide mineralization along a strike length of 1600 feet. Widths up to 16 feet of massive sulphides were encountered. Mineralization consists chiefly of massive to disseminated pyrrhotite, nodular pyrite and minor chalcopyrite. An 8-foot chip sample taken by E.G. Pye (ODM Summary of Field Work, 1965, p.65) was found by the Laboratory Branch to contain 0.42 percent copper and a trace of nickel.

The Canadian Addicks sulphide deposit is in sheared mafic volcanics. It strikes N70°E and dips vertically. Mineralization consists chiefly of massive pyrrhotite, massive and nodular pyrite and minor chalcopyrite. It has been traced for over 100 feet and ranges up to 30 feet wide. A grab sample of chalcopyrite-bearing pyrrhotite taken by E.G. Pye was found by the Laboratory Branch to contain 1.77 percent copper and a trace of nickel.

The Kuhner and Canadian Addicks deposits appear to be associated with the same set of northeasterly-trending lineaments.

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[1] Ontario Dept. Mines, Vol. 48, pt. 1, 1939, p.22.

The Burrex pyrite deposit is in a phyllite near the north end of a small pond (northeast of Copper Hook Lake). Mineralization consists of massive pyrite; the pyrite has been traced for 270 feet and ranges up to 14 feet wide. A grab sample taken by the author was found by the Laboratory Branch to assay 0.16 oz. per ton silver with traces of gold, copper and nickel.

No. 8 WATCOMB-CLARKDON AREA

DISTRICT OF KENORA

by

N. F. Trowell[1]

Location and Means of Access: The Watcomb-Clarkdon map-area. District of Kenora, is bounded by longitudes 91°10' - 91°29'W, and latitudes 49°44' - 49°51'N, and covers approximately 125 square miles. Access may be had by the Canadian National Railways, Port Arthur - Sioux Lookout route, and Highway 599, from Ignace on Highway 17 to Savant Lake.

Mineral Exploration: A copper-molybdenum deposit 850 feet south of Shanty Lake (McIver Lake) was staked and examined in detail (geological, and geophysical survey, and sampling program) by Steep Rock Iron Mines Limited in 1966. Several claims have been staked near a minor shear zone located in the northeast corner of the area. Some geophysical work has also been done in the above area. Poor outcrop exposure has no doubt contributed to the small amount of exploration work done in this area.

General Geology: The bedrock of the area is of Precambrian age. It is overlain by sands and gravels of glacial origin and by recent accumulations of swamp and muskeg. The oldest Precambrian rocks consist of a series of mafic and intermediate volcanic rocks with minor amounts of intercalated sedimentary rocks. These have been intruded by gabbro and diorite in the form of stocks and sills. Felsic rocks were then emplaced beginning with the formation of migmatite, progressing through the formation of hybrid rocks by the granitization of the mafic intrusions, and ending with the development of granitic rocks and the intrusion of granite pegmatite, aplite, and diorite.

Structural Geology: In general, the formations have a strike of northeast to east-northeast. and a dip of more than 80 degrees. The regional fold pattern is essentially defined by the configuration of the major rock units. It appears that the formations have been tightly folded into approximately east-west trending structures. Minor isoclinal folding and cross-folding (?) were observed.

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[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

Only minor faults showing small displacements, were observed. A minor shear zone, showing evidence of crushing, carbonatization, and sulphide mineralization, was observed in the northeast corner of the area. Other minor shear zones, often carbonatized, are noticeable in the volcanic-sedimentary belt and in the altered mafic intrusive rocks.

Economic Geology: Copper-molybdenum mineralization as observed in the Shanty Lake showing tested by Steep Rock Iron Mines Limited, consists of disseminated sulphides in quartz veins, and of sulphide smears along shear planes, in the granite. The quartz veins parallel the direction of shearing. The mineralization consists of chalcopyrite, very fine-grained molybdenite and locally pyrite. Molybdenite is also found in the volcanic rocks at the junction of Shanty Lake and Shanty Creek. Bornite was observed in granite float at the Shanty Lake showing.

The proximity of the Shanty Lake showing to the metagabbro-granite contact suggests that the metagabbro might be the ultimate source of the copper. Analysis of this and other gabbro bodies in the area showed trace amounts of copper, nickel, cobalt, and locally zinc.

Disseminated sulphides were noted in the minor shear zone, located in the northeast corner of the area. Analysis showed trace amounts of copper, nickel, cobalt, and locally gold. The mineralization consists of pyrite, some pyrrhotite, and locally chalcopyrite.

The thickness of the glacial drift probably precludes the possibility of conducting geochemical surveys in the area, but a more detailed geophysical examination of the mafic intrusive bodies could be of importance.

No. 9 CROOKS TOWNSHIP

PRINCE AND JARVIS LOCATIONS

DISTRICT OF THUNDER BAY

by

J.J.C. Geul[1]

Location: The map-area is situated along the northwest shore of Lake Superior about 25 miles southwest of Fort William. Its inland part is bisected by Highway 61; secondary roads give access to Mink Bay, Jarvis Bay, Cloud Bay, Pine Bay and Little Pigeon Bay.

Mineral Exploration: Active prospecting was first carried out during the latter part of the 19th century, following the discovery of silver deposits at Silver Islet, Silver Mountain and Rabbit Mountain to the north of the map-area (see ODM Map 2065). Mining operations for silver took place on Spar and Jarvis Islands, and at the old Prince Mine, situated between Mink Point and Prince Bay. Barite was produced at McKellar and Jarvis Islands.

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[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

The early part of the present century witnessed prospecting for the source of mineralized boulders, containing Cu-Ni-Pt values; and an occurrence of float, containing native copper, was drilled as recently as 1963 by Salem Exploration Ltd.

Exploration in the area was reactivated in the early 1950's by J.S. Brodie, following the in situ discovery of Cu-Ni sulphide mineralization in leucogabbro and troctolite in central Pardee Township. The showings were acquired in 1964 by the Great Lakes Nickel Corporation Limited and since then drilling has indicated the presence of a potential orebody containing an estimated 40,500,000 tons grading 0.6% by weight of combined copper and nickel (Canadian Mines Handbook, 1968-1969, p.153). During 1967 Canadian Exploration Limited investigated the Whitegate-Strickland claims in Crooks Township and the Exploration Division of Anaconda American Brass Limited prospected the Mount Mollie area as part of an extensive regional reconnaissance program.

During the summer of 1968 Phelps Dodge Corporation of Canada Limited optioned an 80 claim group in Crooks Township, covering the Strickland property and adjacent staked claim groups. Geological and geophysical surveys were followed by a diamond drill program to test a gabbro body for Cu-Ni sulphides because of the latter's proximity to the Great Lakes gabbro in Pardee Township.

Other companies active in the area during the summer were Cominco Limited, Amax Exploration Incorporated, and Kennco Explorations (Canada) Limited.

General Geology: The Rove Formation of Animikie age is represented by a banded sequence, made up largely of thick-bedded greywacke with shaly partings and interbeds, interrupted at several horizons by thinly bedded siltstone, silty shales and argillites. It is cut by Keweenawan intrusive rocks which, from oldest to youngest, include tholeiitic diabase and "red rock", occuring as sills; porphyritic diabase, occurring as both sills and dikes; lustre-mottled olivine diabase and associated medium-grained gabbro, occurring as dikes; and medium- to coarse-grained gabbro, metagabbro and olivine gabbro.

The granophyre or "red rock" was found to be present as: (1) porphyritic-textured sills having basal chill zones of diabase; (2) elongated xenolithic zones along the margins of fractured sulphide-bearing gabbro dikes; (3) small dikes and stocks postdating adjacent gabbro bodies; and (4) zones of metasomatic alteration in gabbro, diabase, and in places, greywacke.

There are two principal diabase sheets, each with local sill-like offshoots, in the area. These are: the upper Cloud Lake Sheet, occupying the northwest part of the township; and the lower Cloud Bay - Mink Bay Sheet, occupying the northeast part of the township and the coastal area. Most of the "red rock", as well as the porphyritic diabase, appears to be associated with the lower, Cloud Bay - Mink Bay Sheet. In contradistinction, most of the tholeiitic diabase of the area appears to occur in the upper, Cloud Lake Sheet.

Considered to be younger than the diabase sheets are northeast-trending, steeply dipping dikes of lustre-mottled olivine diabase. The latter are intersected at Mount Mollie by a prominent north-northwest-trending diabase dike, which in turn is intersected by a younger east-trending gabbro. The

Pine River - Mount Mollie gabbro, characterized by a relatively high content of Fe-Ti oxides, continues eastward to McKellar Point.

Post-glacial uplift has resulted in the presence of raised beaches. These were found along the shoreline of Lake Superior at heights of 10-150 feet above the lake level (= 603 feet).

Structure: Block faulting along northeast-trending graben-like structures is thought to have occurred at Mink Bay. Other faults are indicated by narrow diabase-filled, post-red rock breccia zones and calcite-barite-amethyst filled breccia zones, up to several feet in width.

Economic Geology:

Copper-Nickel: Nickeliferous pyrrhotite with visible chalcopyrite, commonly rimming blebs of pyrrhotite, occurs as:
(1) irregular blebs and as disseminated to near-massive pods within and marginal to olivine diabase dikes (the Cu:Ni ratio is usually greater than 1, but generally lower than 2); and
(2) irregularly disseminated grains within and along the basal contact of an olivine diabase sill, just west of Highway 61.

Sulphides also occur as scattered blebs 1-10 mm in diameter, within the Pine River - Mount Mollie gabbro body. This mineralized zone outcrops on Mount Mollie. It has an approximate width of 200 feet and a strike length of 1500 feet or more. Sulphide content is generally less than 5%. The principal minerals, present in most places, are pyrrhotite, pentlandite and chalcopyrite, in addition to ilmenite; minor constituents are mackinawite, niccolite and marcasite.[1]

Another deposit of disseminated sulphides occurs along the north side of Victoria Island. It is in a gabbroic olivine diabase dike and can be traced along strike for 10,000 feet. The property, currently owned by Messrs. Z. Renshaw and N. Kuneman of Fort William, has been tested by a number of irregularly spaced diamond drillholes, totalling 1250 feet. Grab samples, taken at the showings by the author, and analysed by the Laboratory Branch, Ontario Dept. of Mines were found to contain up to 0.53% Cu and up to 0.22% Ni.

Barite: Barite is a minor constituent of many calcite veins. The prominent barite-bearing calcite veins occur on Spar and Jarvis Islands, and have been described by Guillet.[2] The Spar Island vein also contains disseminated grains of chalcocite and in addition, other sulphides containing copper, zinc and lead. Calcite-filled breccia zones are fairly numerous in the coastal area and many were found to be baritiferous; the veins are usually 1-2 feet wide and may extend for several hundreds of feet. The veins are steeply dipping. They strike either northwest, e.g., the ones on Spar and Jarvis Islands, or northeast, roughly parallel to the diabase dike swarm in the coastal area. A grab sample from a boulder, obviously derived from a nearby rock cut in a northwest-striking vein on Naomi Island, was found by the Laboratory Branch to contain 5% Zn in the form of sphalerite. Traces of silver are associated with many of the calcite veins.

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[1]J.B. Hesslop, 1968: Unpublished B.Sc. thesis, University of Western Ontario.

[2]G.R. Guillet, 1963: Barite in Ontario; Ontario Department of Mines, Industrial Mineral Report No. 10, p. 7-8, 11-12.

Amethyst is often present in the breccia zones, locally in sub-economic quantities, as for example in the Prince Location. Here, a breccia zone striking north-northwest cuts a diabase sill in contact with, and overlying, Rove sediments. This zone is filled with quartz and amethyst. The zone is 12-18 inches wide and extends for several hundred feet in length.

Native Copper: Native copper occurs in Keweenawan-type lava float, located about 1 1/2 miles east of Cloud Lake. The showings were explored by Salem Exploration Limited in 1963 and 1964 by trenching and diamond drilling (11 holes aggregated 437 feet). Assessment work files show the area, in which the mineralized lava occurs, to be about 100 feet long, 50 feet wide and up to 15 feet thick. High grade copper was reported to be present in one hole over a core length of up to 5 feet. Native copper occurs in the vesicular, hematite-stained lava as blebs up to 1 inch in diameter, and, more commonly, as small grains 1-3 mm in diameter, surrounded by malachite.

Sand and Gravel: Pleistocene and Recent lake gravels and sands are present in sizeable quantities along the shoreline of Lake Superior, along the Memory Road, Little Pigeon Bay Road and also along Highway 61 along the northern boundary of the map-area.

No. 10 WALTERS AND LEDUC TOWNSHIPS

DISTRICT OF THUNDER BAY

by

W.O. Mackasey[1]

Location: Walters and Leduc Townships are located east of Lake Nipigon and form part of the "Sturgeon River Gold Belt". Port Arthur is 135 miles to the southwest via Highway 11.

The Trans-Canada natural gas pipeline, Canadian National Railway line and the Trans-Canada Northern Route (Highway 11) cross the southern part of the map-area. Highway 801 runs north through Walters Township. Lumber roads and canoe routes provide excellent access throughout most of the map-area.

An airport having a 3,000-foot compacted gravel runway is located north of Blackwater Lake in Leduc Township.

Mineral Exploration: Gold has been one of the main interests in the region since 1925. Iron, and more recently sulphide deposits have also been under investigation.

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[1]Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

Geological mapping, geophysical surveying, trenching, sampling, and diamond drilling for gold have been carried out in many parts of the map-area over the past 30 years. In 1936, a pilot shaft on the former Oremond Gold Mines Limited property was completed to a depth of 300 feet. The Sturgeon River gold mine, 2,000 feet west of Walters Township, was in production from 1937 to 1942.

Sulphide occurrences are numerous and some have been tested by trenching and diamond drilling.

In 1968, geological and geophysical surveys were conducted by Federal Wire and Cable Company in Walters Township.

Some stripping for iron formation was done in the map-area. Central Manitoba Mines Limited investigated the iron formation in the Watson - Doris Lake area. A total of seven diamond drill holes was completed on the north shore of Watson Lake, Irwin Township in 1957.

Several claim groups, including patented and leased claims, are currently held in the map-area.

General Geology: Walters and Leduc Townships are underlain by Keewatin-type mafic and felsic volcanic and Timiskaming-type sedimentary rocks.

The sedimentary rocks form three belts trending east across the map-area. The south belt consists of interbedded argillite, siltstone and greywacke; the central belt of feldspathic sandstone, conglomerate, siltstone and argillite; while the third and northernmost belt is dominantly conglomerate.

Mafic volcanic rocks are exposed between the sedimentary belts. Most lavas are massive basaltic types, but bands of deformed pillows, amygdaloidal zones, and breccia exist. Felsic tuff, agglomerate, and flows are present in the northern part of the map-area.

A granitic stock intrudes the felsic volcanic rocks north of Paint Lake. Several small lenticular bodies of altered mafic to intermediate intrusive rocks are present north of Paint Lake and the Namewaminikan (Sturgeon) River. Diorite and quartz diorite cut sedimentary and volcanic rocks at Oxaline Lake. North-south striking diabase dikes are present throughout the map-area.

Structural Geology: The sedimentary and volcanic rocks in this map-area form part of an east-west fold belt. Foliation is generally parallel to bedding but several observations were made in which cleavage cuts across bedding. Crenulations and drag folds are abundant in the fine-grained clastic rocks.

Major faulting is east-west and forms distinctive linears, the most prominent being at Paint Lake.

Economic Geology:

Gold: Gold occurs in fracture-filling quartz veins, pyritic replacements in iron formation, and quartz-sulphide replacement zones.

The Sturgeon River gold mine, which is located near the northwest corner

of Walters Township, produced a total of 73,438 oz. of gold and 15,922 oz. of silver worth $2,728,905[1]. Production came from quartz veins cutting volcanic and intrusive rocks.

At the Pappas property (formerly Oremond Gold Mines) gold values occur in fractured and sheared iron formation which has been replaced in part by pyrite and minor arsenopyrite. Underground levels were established at 150 and 275 feet and a total of 392 feet of crosscutting and 584 feet of drifting was completed[2].

A test pit found 2500 feet south of the west narrows on Paint Lake exposed quartz stringers in rusty, sheared mafic lava. A grab sample collected by the field party was reported by the Laboratory Branch, Ontario Dept. of Mines, to contain 0.17 oz. Au/ton, 0.40 oz. Ag/ton and trace of copper and lead.

Sulphides: Several small quartz-sulphide occurrences near the western contact of a granitic stock in northwest Walters Township and part of Elmhirst Township were examined by the field party. A selected grab sample collected from a narrow shear zone on the Coniagas Mines Limited property, 1000 feet north of Walters Township on the west side of Highway 801, was assayed by the Laboratory Branch, Ontario Dept. of Mines, and found to contain 1.68% Cu, 1.90% Zn, 0.03 oz. Au/ton and 1.01 oz. Ag/ton. Float found near mineralized quartz veins approximately 1300 feet south of the Walters - Elmhirst Township line near Highway 801 was assayed by the Laboratory Branch and contained 4.80% Cu, 3.48% Ni, 0.02 oz. Au/ton, 1.40 oz. Ag/ton with minor amounts of Pb, Zn and Co. It was noted, however, that the float is more massive and somewhat dissimilar to sulphides found in the surrounding area and may possibly be from a far removed source. A grab sample taken by the author from a test pit north of the Sturgeon River and near Barnum Green Rapids in Elmhirst Township was reported by the Laboratory Branch to contain 1.65% Cu, 0.01 oz. Au/ton, 0.47 oz. Ag/ton and a trace of molybdenum. A possible spatial relationship exists between the granitic stock and the sulphide occurrences.

A minor amount of galena with a trace of silver was found in a test pit near Highway 801 approximately 4000 feet north of Highway 11. Mineralization occurs along a N-S trending fault zone in fine-grained clastic sediments.

Minor amounts of chalcopyrite and pyrrhotite were found in the mafic volcanic rocks within the map-area.

Iron: A narrow band of iron formation extends east-west across the southern part of the map-area. A 20-foot wide exposure north of Doris Lake consists of thin bands of jasper and magnetite interbedded with argillite. A grab sample collected by the field party was found by the Laboratory Branch, Ontario Dept. of Mines, to contain 33.3% Fe. A 25-foot wide exposure on the south shore of Oxaline Lake consists of thin layers of magnetite and hematite interbedded with fine-grained clastic sediments. A selected grab sample analyzed by the Laboratory Branch, contained 52.2% Fe.

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[1]Statistical files, Ontario Dept. of Mines.

[2]Ontario Dept. Mines, Vol. 46, pt. 1, 1937, p.188.

Angular fragments of low grade hematitic iron formation were found on the shoreline of the southwest part of Beatty Lake.

Sand and Gravel: Thick deposits of sand and gravel occur in the Pasha - Beatty Lake area. The Ontario Department of Highways maintains gravel reserves in the southern part of Leduc Township.

No. 11 MANITOUWADGE AREA

DISTRICT OF THUNDER BAY

by

V.G. Milne[1]

Introduction: In 1968, the Ontario Department of Mines, with the co-operation of Noranda Mines Ltd., Willroy Mines Ltd. and Willecho Mines Ltd., commenced an 800 feet to 1 inch surface mapping programme of a 37 square mile area in Gemmell and Mapledoram Townships. Underground examination and special studies are being made of the copper-zinc-silver orebodies. The project will continue through 1969.

Location: The area lies within Gemmell and Mapledoram Townships, extending west from Mose Lake to Nama Creek and north from the township line to Rabbitskin Lake. The town of Manitouwadge lies just south of the map-area and is connected with the Trans-Canada Highway (No. 17), 35 miles to the south, by Ontario Highway No. 614. The town is also linked to Trans-Canada Highway (No. 11), 80 miles to the north, in part by an industrial road and in part by Ontario Highway No. 625. Mapping in 1968 was concentrated on the eastern half of the area encompassing the Geco Mine property of Noranda Mines Ltd. and the Willroy Mines Ltd. property.

Mineral Exploration: A detailed account of the exploration in the area to 1957 has been given by E.G. Pye[2]. In 1957, two mines were in operation, the Willroy Mine and the Geco Mine. Since that time, the Willecho Mine has been brought into production (1965) and the Big Nama Creek Mine is at present being prepared for production. No new orebodies have been discovered in the area since 1957, other than a number of new ore zones encountered in development and exploration work within the three operating mines. Deep drilling by Willroy Mines Limited in the granitic area north of the mine has indicated that the ore-bearing horizons of the east-plunging regional syncline continue under the granitic rocks. Some mineralization was encountered in this drilling which opens up a whole new area of economic potential. The granitic area west of a line between Rabbitskin Lake and the Willroy Mine is largely covered

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[1]Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

[2]E.G. Pye, 1957: Ontario Dept. Mines, Vol. 66, pt. 8.

by claims of Willroy Mines Limited and associated companies, and in 1968 Noranda Mines Limited, (Geco Division) staked 61 claims in the area between the Geco Mine, Rabbitskin Lake and Dead Lake. Geological mapping of the latter area was completed during the summer of 1968 and future drilling is planned. Some drilling was done by Hucamp Mines Limited in 1960 and 1964 on their property east of the Geco Mine.

General Geology: The geology of the area has been described by E.G. Pye[1]. An accumulation of pillowed mafic metavolcanic rocks is overlain by well bedded biotitic, quartzo-feldspathic metasediments which are in turn superseded by a zone of abundant iron formation deposition. These rocks have been intruded by metagabbro and by at least four major granitic phases. Subsequently all these rocks were intruded by diabase dikes. The availability of more detailed information has permitted subdivision of the stratigraphy to a greater extent than was previously possible. To the extent that the mapping has progressed, the stratigraphic units exhibit a thickening from east to west with associated facies changes. Assuming that this condition prevails around the nose of the regional syncline it would appear that the Manitouwadge syncline is centred on an original depositional basin.

Structure: The Manitouwadge Syncline is the dominating structure within the map-area. This syncline plunges about 35°E within the area mapped. The core of the syncline and the surrounding area are occupied by granitic gneisses but as indicated by drilling the metavolcanic and metasedimentary rocks continue on plunge beneath the granitic rocks in the core. Small scale folding conforms to the regional trend but is quite limited except in some iron formation and muscovite schist horizons. A second stage of deformation associated with strike faulting is developed in the muscovite schist zones and folds of this stage plunge east and west. These structures are dislocated by later northwest, northeast and north-south trending faults.

Economic Geology: There are three copper-zinc-silver mines in production in the area and a fourth, the Big Nama Creek Mine is being prepared for production by Willroy Mines Limited. Along strike the orebodies are roughly lenticular in form and all plunge eastwards following the structural trend of the region. The orebodies generally have massive and disseminated parts, the important sulphide minerals in these being pyrite, pyrrhotite, sphalerite, chalcopyrite and minor galena. The host rock in the Geco Mine and in the Willroy No. 1 and No. 6 orebodies is muscovite schist while iron formation appears to be the main host rock of the remaining orebodies. Ore textures in the different mines are essentially the same and predominantly coarse-grained. The ratios of zinc to copper and pyrite to pyrrhotite are invariably higher in the massive ore than in the disseminated ore. In generalized small scale plans, the orebodies appear conformable with the enclosing rocks but discordant relationships are clearly evident from detailed mapping. At the Geco Mine specifically the massive ore is discordant to small scale folding in the muscovite schist and transgresses the muscovite schist zone. The following table lists the production figures[2] and reserve figures[3] for the mines as of December 31, 1967.

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[1]E.G. Pye, op. cit.

[2]Statistical files, Ontario Dept. Mines.

[3]Canadian Mines Handbook, 1968-1969; Northern Miner Press Ltd.

	Geco Mine (Noranda Mines Ltd.)	Willroy Mine	Willecho Mine
Production			
Ore treated	1,460,800 tons	165,053 tons	338,437 tons
Copper	27,810 tons	1,866,746 lbs.	3,341,132 lbs.
Zinc	40,500 tons	9,063,632 lbs.	19,594,001 lbs.
Lead	1,130 tons	330,446 lbs.	1,128,514 lbs.
Silver	2,193,900 ozs.	114,431 ozs.	359,992 ozs.
Gold	4,880 ozs.	325 ozs.	673 ozs.

Reserves

Geco Mine	26,719,000 tons, 2.10% copper, 5.07% zinc, 2.20 ozs./ton silver
Willroy Mine	505,952 tons, 1.10% copper, 1.91% zinc, 0.01% lead, 0.68 ozs./ton silver
Willecho Mine	2,163,000 tons, 0.50% copper, 4.43% zinc, 0.18% lead, 1.98 ozs./ton silver
Big Nama Creek Mine	828,000 tons, 0.79% copper, 3.25% zinc, 0.75 ozs./ton silver

No. 12 OPERATION PUKASKWA

DISTRICTS OF THUNDER BAY AND ALGOMA

by

G. Bennett[1], P.C. Thurston[1], and J.F. Giguere[2]

Introduction and Location: Operation Pukaskwa is the third helicopter-supported, reconnaissance, geological mapping project undertaken by the Ontario Department of Mines.

The map-area comprises approximately 2,500 square miles which lies between longitude 85°00' and longitude 86°20'. The northern boundary is 48°40' and the southern boundary is the north shore of Lake Superior.

A preliminary map of this area will be published at a scale of one inch equals two miles. In addition, two geological maps covering approximately the southern third of the area will be published at a scale of one inch to one mile.

General Geology: There are three major metavolcanic-metasedimentary belts

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[1]Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

[2]Geologist, Ontario Department of Mines, 1496 Wellington Street E., Sault Ste. Marie, Ontario.

within the map-area. The most northerly of these is the Playter Harbour belt which extends from the coast of Lake Superior, south of Marathon, eastward to Rous Lake where it joins the Marathon metavolcanic-metasedimentary belt. Its width varies from 1 to 1.5 miles. The western portion of the belt consists predominantly of mafic metavolcanics with a minor amount of metasediments at the northern edge. The thickness of metasediments increases toward the east. Structural data indicate that the Playter Harbour belt is the south limb of a syncline which plunges 30°NW.

The Kabenung Lake belt extends from the east edge of the map-area at Kabenung Lake for a distance of about 30 miles towards the southwest. The width of the belt varies from 4 to 8 miles. It is synclinal in form. The oldest rocks of the syncline are mafic metavolcanics which are locally intercalated with felsic metavolcanics. Overlying the metavolcanics is a sequence of metasediments which includes iron formation, greywacke, argillite, arkose and conglomerate. Early mafic sills intrude the metavolcanics but not the younger metasediments. Near the edges of the belt the volcanics have been recrystallized to medium- to coarse-grained mafic rocks resembling gabbro and diorite. Throughout most of the belt only greenschist facies metamorphism has been reached.

The third major metavolcanic-metasedimentary belt extends from the University River on the shore of Lake Superior, through Mishibishu Lake and continues westward to the mouth of Pukaskwa River. The rocks of this belt are similar in most respects to those of the Kabenung Lake belt. There does, however, appear to be less felsic metavolcanics in the Mishibishu Lake belt and the conglomerate unit contains a higher proportion of granite cobbles than Kabenung Lake belt. A few remnants of Keweenawan felsic volcanics are located at the bottom of some stream valleys near the shore of Lake Superior and on the shore itself. These occurrences are less than one tenth of a square mile in area. In the vicinity of Pukasaw, the metavolcanics interfinger with the granitic rocks producing a confusing variety of hybrid rocks.

About 70 to 80 percent of the map-area is underlain by granitic rocks. These include granodiorite, trondhjemite and quartz monzonite. The granitic rocks may be massive, foliated or gneissic. Porphyritic varieties are common. A body of pegmatitic, muscovite granite about 5 miles in diameter is located near the western edge of the map-area.

Diabase dikes of diverse trends intrude the granites and mafic metavolcanics. A swarm of diabase dikes, which are probably Keweenawan in age, intrude the Archean rocks near the mouth of Pukaskwa River.

Structural Geology: The Kabenung Lake belt and the Mishibishu Lake belt form adjacent synclines separated by a granite batholith. Cross folding and local deformation is particularly evident adjacent to stocks of granite and syenite which intrude the belts.

Despite the development of negative topographic lineaments throughout most of the map-area, faulting does not appear to be an important factor in determining the boundaries of the mafic metavolcanic belts. Marker horizons were found to continue for the entire length of the belt without significant displacement.

Economic Geology: Immediately south of Heart Lake in Township 32, Range 26 an ill-defined zone of pyrite-chalcopyrite mineralization extends over a length of 3,000 feet with a trend of N65°E to N70°E. Disseminated sulphides and stringers of pyrite with minor chalcopyrite occur in sheared and altered mafic to intermediate metavolcanics.

Falconbridge Nickel Mines Limited and Jonsmith Mines Limited carried out geological mapping, geophysical surveys and some diamond drilling over parts of this mineralized zone in 1962. However values over minable widths were low and the claims were allowed to lapse. Acme Oil and Gas Co. Limited has since held the township on a lease from the Algoma Central Railway but the results of their work have not been revealed.

International Bibis Tin Mines Limited staked 54 claims near the western end of the Kabenung Lake metavolcanic-metasedimentary belt. Diamond drilling during the winter of 1967 intersected interesting copper values in altered intermediate to felsic metavolcanics. There was no activity in the area of this prospect during the 1968 field season.

In 1965 Sutherland and Associates drilled 14 diamond drill holes to test a copper prospect located about 1 1/2 miles north of the Lake Superior shore and 3 miles east of Point Isacor. The mineralization is predominantly pyrite with chalcopyrite. Assays were low and erratic. There was no activity on the prospect during the 1968 field season.

There are several old copper prospects within the map-area but none have been active in recent years.

Hollinger Consolidated Gold Mines Limited held a gold property north of Mishibishu Lake around 1935. Five grab samples taken from this prospect during the past field season were assayed by the Laboratory Branch, Ontario Department of Mines. One sample assayed 0.82 ounces gold per ton; a second sample, 0.40 ounces per ton. The remaining three samples were found to have only low gold contents.

In 1952 about 50 "Pack-sack" drillholes were drilled in a scheelite deposit located on the north shore of Lake Superior in Township 32, Range 23. The scheelite occurs in quartz veins within a thin band of metasediments and metavolcanics which is surrounded by granitic rocks. The scheelite mineralization was found to be scarce and there is no report of work on the property since 1952.

Several significant iron prospects are found within the Kabenung Lake belt between Kabenung Lake and Abbie Lake. The iron formation is of the Algoma type and includes oxide, carbonate and sulphide facies. All of these deposits are very well described in the reports by J.M. Bell[1] and A.M. Goodwin[2].

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1 Bell, J.M., Ontario Bur. Mines, Vol. 14, 1905, p. 278-355.
2 Files, Resident Geologist's office, Sault Ste. Marie, Ontario.

No. 13 RECONNAISSANCE GEOCHEMICAL SURVEY, PUKASKWA REGION

DISTRICTS OF ALGOMA AND THUNDER BAY

by

W. J. Wolfe[1]

A helicopter-supported reconnaissance geochemical survey was combined with geological mapping ("Operation Pukaskwa") in a 1200 square-mile area extending from Lake Superior to latitude 48°20' and bounded to the east and west by longitudes 85°00' and 86°00'. Occurrences of base metal mineralization are mainly confined to belts of volcanic-sedimentary assemblages (mafic to intermediate flows, tuffs, agglomerate, conglomerate, greywacke, quartzite, iron formation, siltstone and slate) that underlie about 50 percent of the area. Large blocks of granitic terrain constitute the remaining 50 percent of the region.

Streams draining areas underlain by volcanic and sedimentary rocks were traversed by two-man field parties and sediment samples were collected at intervals of 1,200 to 1,500 feet. In addition to sampling of the finest sediment fraction for later laboratory analysis, pH measurements, water temperature data and information concerning sediment composition and stream environment were routinely recorded. A dithizone colorimetric field test for ammonium citrate extractable heavy metal was performed on the dried -80 mesh sieve fraction of sediment samples. The same fraction was used in the laboratory determination of hot HCl-HNO_3 extractable Cu, Pb, Zn, Ni, Co, Mn and Mo. A number of base metal anomalies occur throughout the district, and some of these deserve further investigation.

Specimens of rock weighing between 2 and 3 pounds were taken, where possible, from outcrops at intervals of about one mile. At each station a single specimen of the most common rock type was taken along with a smaller chip to be retained for reference. After crushing and grinding, the resulting rock powders were analysed for absolute amounts of Cu, Pb, Zn, Ni, Co, Mn and Mo.

Statistical analysis and compilation of the chemical data is now in progress in preparation for the publication of the data in the form of single element geochemical maps at a scale of one inch to one mile.

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[1]Geochemist, Ontario Department of Mines, Parliament Buildings, Toronto.

No. 14 RAWHIDE LAKE AREA (TOWNSHIPS 145 AND 151)

DISTRICT OF ALGOMA

by

J. Wood[1]

Location: The centre of the area is located 13 miles north of Elliot Lake. Highway 639 just cuts the southwest corner of Township 151. There are no other roads in the area, so that floatplanes are required for access to most parts of it.

Mineral Exploration: Apart from work done (1964-1965) by Sutherland & Associates in the vicinity of Stag Lake to evaluate an occurrence of chalcopyrite in the upper part of the Lorrain Formation, there has been little serious exploration activity in the area, although it has been explored by individual prospectors. Much of the area was staked this year when ground previously within the Mississagi Provincial Park was re-opened for staking.

General Geology: Geologically the area can be divided into two parts. One, a triangular region comprising the northwest part of the area, is underlain by Huronian sedimentary rocks; the other is underlain by Archean metasedimentary, metavolcanic, and igneous rocks. A major east-northeast striking fault, the Flack Lake Fault, separates the two.

The geology of that part of the area underlain by Archean rocks is complex. In simplified form, four broad subdivisions can be made on the basis of rock type. The boundaries between three of these subdivisions strike in a general northwest-southeast direction. The remaining boundary strikes northeast-southwest and thus delineates a triangle the apex of which is the southeast corner of Township 145. The major rock type in this triangular area is a coarse-grained porphyritic (feldspar phenocrysts) biotite-hornblende granodiorite, although mafic and felsic metavolcanics with metasediments (often iron-rich) are common.

From the northeast corner of Township 145 towards the southwest corner of Township 151 the subdivisions increase in size. Approximate widths are: 2 miles, 3 miles, and 9 miles. The first subdivision is characterized by grey to pink coloured granitic rocks of variable composition in which inclusions of mafic metavolcanics and quartz-rich metasediments are quite common. The rock-type in the second subdivision is a strongly foliated feldspar-hornblende-(biotite)-rock, generally somewhat reddish in overall colour, and gneissic in appearance. Inclusions of metavolcanic or metasedimentary material are very rare, and contacts with metavolcanic and metasedimentary material in subdivision three suggest that this gneissic rock is not an "in situ" result of regional metamorphism, but was introduced as a mobile mass and crystallized under high pressure. The third subdivison - the largest and most complex - is a terrane of metavolcanic and metasedimentary rocks. The volcanics occur in belts

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of mafic and felsic flows. There are some undersaturated and intermediate types, but they are relatively uncommon - tholeiitic basalts and rhyolite being most abundant. Most flows are massive, some are pillowed, and many of the mafic flows are porphyritic. Associated with the felsic volcanics are metasediments - mostly white-weathering metagreywackes with interbedded meta-pelites. Metamorphosed iron formation is present in several places.

Although all of the mineral assemblages in the third subdivision can be placed within the greenschist facies, metamorphic grade together with intensity of structural deformation decreases in a southwesterly direction, so that in the southwest part of the subdivision mafic lavas may be confused with later mafic intrusions.

These mafic intrusions - dikes and sills - are ubiquitous within that part of the area underlain by Archean rocks. They vary little in overall composition, but widely in texture and degree of alteration. Age relationships suggest many periods of intrusion. Most of the intrusions are probably the equivalents of "Nipissing" diabase bodies found elsewhere, but there are some which are probably Pre-Kenoran in age. The youngest intrusions in the area are NW-SE-trending Keweenawan-type olivine diabase dikes which cut both the Archean and the Huronian rocks.

In the northwest part of the area three Huronian formations are represented. The middle and upper parts of the Lorrain Formation is represented by fine- to medium-grained feldspathic quartzite with bedded quartz and jasper - pebble conglomerates and orthoquartzite respectively.

The Gordon Lake Formation is represented by a very fine-grained, banded, siliceous rock type. Green chert beds are common within the sequence, and near the top the beds become more buff coloured and sandy.

The Bar River Formation is represented by a sequence of orthoquartzites. There are several colour variations and hematite is often a minor constituent. Crossbedding is abundant.

Metamorphic grade of the Huronian rocks is greenschist facies.

Structure: The Flack Lake Fault, a major structural feature in itself, separates the area into two parts which have markedly different structural styles and histories. The Archean rocks are quite strongly deformed; in some localities isoclinal folds can be observed. However abundant mafic intrusions and the sparsity of top determinations prevent the precise outlining of large-scale structures. Most of the deformation visible is probably either Kencran or Pre-Kenoran in age.

Folds in the Huronian rocks increase in amplitude from north to south and may be the result of gravity sliding towards the south. Cleavage in these rocks dips steeply south. A Nipissing-type diabase sill follows the contact between the Gordon Lake and Bar River Formations.

Economic Geology: Small amounts of sulphides are disseminated throughout the mafic rocks in the area. In the volcanic sequence gossans and sulphide minerals (pyrite, chalcopyrite, pyrrhotite and possibly sphalerite) found in

parts of the area were almost invariably associated with metarhyolites and metasediments. There appears to have been little exploration for base metals to date. However, exploration using modern apparatus and techniques might yield interesting results.

Chalcopyrite occurs in the upper part of the Lorrain Formation[1] but mineralization is low grade.

The upper part of the Lorrain Formation and parts of the Bar River Formation have potential as a source of silica.

Deposits of sand and gravel are distributed throughout the area.

No. 15 BAY OF ISLANDS - MCGREGOR BAY AREA

DISTRICT OF SUDBURY

by

K. D. Card[2]

Location: The Bay of Islands -McGregor Bay area is bounded by latitudes 45°52'32" and 46°07'30" and by longitudes 81°30' and 82°00' and includes the islands and peninsulas of the north channel of Georgian Bay, Great Cloche Island, and part of Manitoulin Island. The map-area includes approximately 330 square miles. Detailed mapping was commenced in 1967 and 115 square miles were completed. The remainder of the area was mapped during the first half of the 1968 field season. Access is provided by Highway 68 which joins Espanola and Manitoulin Island, by Highway 637 to Killarney, and by water.

Mineral Exploration: There are no producing mines in the area. However, a quartzite quarry on Badgeley Point has been operated by various owners intermittently since 1911, and from 1914 to 1966 inclusive yielded 4,833,247 tons of material having a gross value of $10,772,931.[3] In 1968, the quarry was acquired by Industrial Minerals of Canada Limited. Industrial Minerals have announced plans to bring the quarry into production and to develop a new quarry on nearby Badgeley Island. Canadian Silica Corporation Limited produced quartzite from the Sheguiandah Quarry on Manitoulin Island but this operation was suspended several years ago. Copper, cobalt, and gold have been found in sporadically distributed sulphide occurrences in McGregor Bay.

General Geology: Precambrian metasediments considered by the author to be of Huronian age and mafic intrusive rocks underlie the area. The Precambrian rocks are unconformably overlain by Paleozoic limestones, dolomites, and shales. Cenozoic deposits of sand, gravel, and clay partly mask the bedrock.

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1 Files, Resident Geologist's Office, Sault Ste. Marie, Ontario.
2 Geologist, Ontario Department of Mines, 1349 LaSalle Blvd., Sudbury, Ontario.
3 Statistical Files, Ontario Department of Mines.

The metasediments consist of sandstone, conglomerate, siltstone, and argillite with a total thickness of about 30,000 feet. They are divisible into eight lithostratigraphic formations which are tentatively correlated with the "type" Huronian section to the west. The lowermost formation in this area, the Mississagi, consists of at least 4000 feet of feldspathic sandstone, micaceous sandstone, and argillite. Crossbedding is characteristic.

The Bruce Formation, which abruptly overlies the Mississagi, consists of 0 to 450 feet of polymictic paraconglomerate with a greywacke or proto-quartzite matrix. The pebbles, cobbles, and boulders include granitic rocks, quartz, and amphibolitic material.

The Espanola Formation conformably overlies the Bruce and consists of a thin, lower limestone-siltstone member, a thick, middle calcareous siltstone member, and a thick, upper calcareous sandstone-siltstone member. The total thickness is about 1,000 to 2,000 feet. Sedimentary structures such as laminated bedding, mudcracks, crossbedding, and ripple marks are abundant. Metamorphism has resulted in the development of actinolite, scapolite, chlorite, and phlogopite porphyroblasts.

Rocks of the Serpent Formation gradationally overlie the Espanola, and include 800 to 2,400 feet of feldspathic and micaceous sandstone and calcareous siltstone.

The Gowganda Formation conformably to disconformably overlies the Serpent sandstones. The Gowganda is divisible into two main units, a lower conglomerate-argillite sequence about 2,000 feet thick, and an upper sandstone-siltstone sequence about 1,000 to 1,500 feet thick. The presence of rafted pebbles, bedded tilloid-type conglomerate, and laminated siltstone indicates that the lower unit is probably of marine glacial origin.

The Lorrain Formation, which conformably overlies the Gowganda consists of about 1,000 feet of micaceous sandstone and siltstone, 1,300 feet of feldspathic sandstone, 600 to 1,800 feet of green micaceous sandstone, 200 to 600 feet of hematitic sandstone, 1,800 to 3,600 feet of white kaolinitic sandstone, and 500 to 1,800 feet of pure orthoquartzite. Crossbedding and ripple marks are abundant. Regional metamorphism has developed porphyroblasts of kyanite and andalusite in the kaolinitic sandstones. Dumortierite was noted in quartz veins in these rocks.

The Gordon Lake Formation conformably overlies the Lorrain and consists of 1,800 to 3,600 feet of interbedded siltstone, argillite, and micaceous sandstone. Ripple marks and small scale crossbedding are common. Near the Killarney granite the Gordon Lake rocks have been metamorphosed to spotted hornfels.

Sandstones of the Bar River Formation conformably overlie the Gordon Lake rocks. They consist of 1,000 to 1,200 feet white orthoquartzite, and at least

1,800 feet of interbedded laminated, feldspathic sandstone, micaceous sandstone, argillite, and siltstone. Several of the argillite-siltstone units contain minor amounts of magnetite and hematite. The Bar River rocks contain abundant ripple marks and crossbeds.

In addition, amygdaloidal and porphyritic metabasalt occurs on several islands in Lake Huron. These rocks apparently overlie the Bar River Formation, although the relationships are obscured by water, overburden, and granitic intrusions.

Primary depositional features indicate that most of the Huronian metasediments were deposited under shallow water, marine conditions or fluvial-deltaic conditions. Paleocurrent determinations on crossbedding and ripple marks show that in the northern and western parts of the area the depositional currents flowed generally from north to south. In the eastern and southern portions, the main paleocurrent directions are from the south and east. This may indicate that there was a source area for sediments within the Grenville Province to the south.

The metasediments are intruded by: Nipissing-type gabbro, dated at 2,150 million years[1]; younger amphibolite dikes; the Killarney granite dated at 1,585 million years[2]; and late olivine diabase dikes dated at 1,200 million years[3]. The Killarney granite has contact metamorphosed the Huronian metasediments, and there is a wide zone of agmatite along this contact.

Structural Geology: The major structures of the area are subisoclinal anticlines and synclines whose axes strike east-west and plunge eastward at angles of 0° to 40°. In addition, there are smaller, more open, superimposed folds whose axes strike east-west to northwest-southeast and plunge both east and west at angles of 10° to 50°. Late northwest- to northeast-trending strain slip cleavage and kink folds are superimposed on all the earlier structures.

There are three main fault orientations; east-west, northeast, and northwest. The east-west faults were probably active during sedimentation, and during and after the various folding events. They are apparently steep reverse faults and could be termed "tectonic slides" in that they are approximately parallel to the axial surfaces of the major folds and were formed in close connection with folding.

Several breccia zones affect rocks of the Mississagi, Espanola, Gowganda, and Lorrain formations in the central part of the area. The breccias consist of angular to rounded blocks of country rocks in a crush matrix, or in a vein quartz matrix.

Study of the spatial and temporal relationships of the various structural elements, breccia, igneous intrusions, and metamorphic features leads to the following conclusions:

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[1] Van Schmus, W.R., 1965: The geochronology of the Blind River-Bruce Mines
[2] Mines Area, Ontario, Canada; Jour. Geol., Vol. 73, p. 775-780.
[3] Frarey, M.V., personal communication.
Lowdon, J.A., 1963: Age determinations and geological studies; Geol. Surv. Canada, Paper 63-17.

(1) the deformation is polyphase and major folding occurred before intrusion of the Nipissing-type gabbro (2150 m.y.) and before brecciation.
(2) the second deformation occurred after gabbro intrusion and brecciation. In some localities, this event accompanied high-grade regional metamorphism; in other localities, it was earlier than the regional metamorphism.
(3) the third deformation, expressed by strain-slip cleavages and kink folds, was later than regional metamorphism.

Metamorphism: The rocks of the area have been affected by regional metamorphism corresponding to the middle and upper greenschist facies and the almandine amphibolite facies. In the Espanola Formation, there is development of actinolite, scapolite, phlogopite, and chlorite. Biotite occurs throughout the Gowganda, and in several localities garnet, staurolite, and andalusite also occur. Kyanite and andalusite, together with muscovite, pyrophyllite, and kaolinite occur in Lorrain sandstone. The distribution of the various metamorphic minerals indicates that the grade of metamorphism increases from greenschist facies in the north and west to almandine amphibolite facies in the south and east.

Economic Geology: Several sulphide occurrences in the McGregor Bay area, the cleaved quartzite occurrence at Birch Island, and trap rock possibilities in the area were described by the author[1].

The main development in the area is that of Industrial Minerals of Canada Limited west of Killarney. The Killarney Quarry, formerly owned by Union Carbide Canada Limited, was purchased by Industrial Minerals of Canada Limited, and plans have been announced to renew production in the near future. In addition, the company plans to establish a quarry on nearby Badgeley Island where there is a large tonnage of high grade material. In addition to the above areas, there are partly developed reserves of orthoquartzite at the Sheguiandah Quarry. The feasibility of establishing orthoquartzite quarries at other localities such as Centre Island and in Narrow Bay should also be investigated.

No. 16 LOUISE-EDEN AREA

DISTRICT OF SUDBURY

by

K. D. Card[2]

Location: The Louise-Eden Area, of about 140 square miles extent, is bounded by latitude 46°15', the west boundary of Louise and Dieppe Townships, the east boundary of Eden and Bevin Townships, and the north boundary of Louise and Eden Townships. During the latter half of the 1967 field-season, Louise

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[1] Card, K.D., 1967: Bay of Islands-McGregor Bay Area, District of Sudbury; in Summary of Fieldwork, 1967; Ontario Dept. Mines, Misc. Paper 11, p. 46-50.

[2] Geologist, Ontario Department of Mines, 1349 LaSalle Blvd., Sudbury, Ontario.

Township and the northern part of Dieppe Township, an area of about 40 square miles, were mapped in detail. Access to the area is provided by Highway 549 from Highway 17 to Panache Lake, by township roads, and by water.

Mineral Exploration: There are no producing mines in the area, although just to the south, vein quartz is quarried for pre-cast concrete facing and decorative stone by C. Fielding. Minor occurrences of iron sulphide mineralization have been tested in the past.

General Geology: Precambrian sediments considered by the author to be of probable Huronian age and mafic intrusive rocks underlie the area. The bedrock is partly masked by Cenozoic deposits of sand, gravel, and clay.

The metasedimentary sequence, consisting of sandstone, conglomerate, siltstone, and argillite, can be divided into seven lithostratigraphic units which are tentatively correlated with formations to the east and west. The oldest unit in the area, the McKim, is exposed in the northern part of the township and consists mainly of thinly-bedded siltstone, argillite, and fine-grained greywacke, with minor micaceous sandstone. Ripple marks and small-scale crossbedding are common in the formation. Approximately 600 to 1,200 feet of polymictic paraconglomerate and pebbly sandstone of the Ramsay Lake Formation overlie the McKim. The Ramsay Lake is in turn overlain by the Pecors Formation which consists of about 1,600 feet of micaceous and feldspathic sandstone and argillite at the top and bottom, and argillite and siltstone with minor sandstone in the centre. The Mississagi Formation lies gradationally above the Pecors and consists of about 6,500 feet of feldspathic and micaceous sandstone with argillite interbeds and partings. Crossbedding is characteristic of the formation. The Bruce Formation conformably and gradationally overlies the Mississagi. The Bruce consists of about 1,000 feet of polymictic paraconglomerate with numerous interbeds of feldspathic sandstone in the upper and lower parts of the formation. Porphyroblasts of scapolite are abundant in the Bruce conglomerate on the north shore of Lake Panache. The Espanola Formation is about 2,000 feet thick. The lower two-thirds consists of metamorphosed calcareous siltstone, argillite, and limestone while the upper one-third is mainly calcareous sandstone and siltstone. Metamorphic amphiboles and scapolite are developed in the calcareous Espanola rocks. The Serpent Formation, which gradationally overlies the Espanola, is at least 2,500 feet thick and comprises a well-bedded sequence of feldspathic and micaceous sandstones which display abundant crossbedding.

Paleocurrent determinations show that the Huronian sediments were deposited by south-flowing currents in a shallow-water, fluvial-deltaic type environment.

Intrusive into the Huronian sediments are sill-like bodies of Nipissing-type diabase, amphibolite dikes, northwest-trending olivine diabase dikes, and a grey, garnetiferous biotite diorite. The diorite is probably related to granitic intrusive rocks which are abundant along the Grenville Front zone.

Structural Geology: The map-area is located immediately south of the Murray Fault, and this structure passes through the northwest corner of Louise Township. The major structural elements are northeast- to east-west-trending anticlines and synclines. The fold axes plunge both east and west at angles

of 40° to 60°. The folds are subisoclinal and have upright, though commonly curved, axial surfaces and are interrupted by faults which trend east-west, northeast, and northwest. The east-west and northeast faults were probably closely connected with the folding and have caused major repetitions and omissions of stratigraphic units. Apparent horizontal offsets on the northwest faults amount to a few hundred feet.

There are several sets of cleavage in the area. The oldest cleavage, where undeformed, strikes approximately east-west. It is plicated, and commonly obliterated, by a well-developed cleavage striking approximately N50°E parallel to the axial surfaces of the major folds. Finally there are late strain-slip cleavages which strike about N30°E and N25°W.

The various structural elements are the result of three superimposed deformations, the first producing east-west structures, the second northeast-trending structures, and the third northeast- to northwest-trending structures. In this area, in contrast to the McGregor Bay area to the south, the second, northeast-trending deformational event is dominant. This event occurred after the intrusion of the Nipissing-type gabbro and the Sudbury-type breccias.

Sudbury-type breccias, which consist of angular to rounded blocks of country rock, including the various metasedimentary types as well as gabbro, are found in all the rock units with the exception of the late olivine diabase dikes. Shatter cones are also developed throughout the area, especially in the more micaceous rocks.

Economic Geology: There are minor occurrences of sulphides in the Nipissing-type diabase, and in the Bruce conglomerate. Immediately west of the fire-tower in central Louise Township two pits have been sunk into a zone about 15 feet across containing less than 5 percent pyrrhotite and minor chalcopyrite in Nipissing-type diabase. It is not known who dug the pits, and assessment data are not available.

No. 17 MAGNETIC SURVEY OF ROBB, JAMIESON TOWNSHIPS

DISTRICT OF COCHRANE

by

R. S. Middleton[1]

Location: Robb and Jamieson Townships lie 16 road miles northwest of Timmins. Access is provided by Highway 576 which joins Highway 101, 4 miles west of Timmins. The Mattagami, Little Kamiskotia and Kamiskotia Rivers provide access in Jamieson. The Sturgeon Falls powerline may be travelled in eastern Jamieson, while a gravel haulage road provides access to south central Jamieson.

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[1] Geophysicist, Department of Physics, Michigan Technological University, Houghton, Michigan.

Magnetic Survey: A relative, vertical field, ground magnetic picture was obtained by utilizing surveys donated to the project and surveys filed with the Department for assessment work credit. Areas not previously covered were traversed with a Sharpe MF-1-100GST (fluxgate) magnetometer. The whole survey was reduced to the Bristol-Ogden magnetic base station value which was selected as 1000 gammas.

Mineral Exploration: Prospecting in Robb and Jamieson Townships has been extensive and continuous. Exploration commenced in 1908 when prospectors from the Porcupine camp came in the search for gold. Individuals such as G. Jamieson accounted for the bulk of the activity in the early years. In 1926, Hollinger Consolidated Gold Mines Limited commenced a program to develop the present site of Kam-Kotia Mines Limited. Shaft sinking, drifting and diamond drilling had been completed before abandonment in 1928. Under contract with the Wartime Metals Corporation the mine was reactivated in 1942 and produced as an open pit mine until December, 1944.

In the late 1940's and early 1950's, New Walcoro Mines Limited, S. Tesluck, Hollinger Consolidated Gold Mines, The International Nickel Company of Canada, Limited and the Dominion Gulf Company carried out extensive geological and geophysical surveys. All of these companies completed diamond drill programs. Most of this work was concentrated in central and northern Robb Township and southeast of the Kam-Kotia Mine to the Mattagami River in Jamieson Township.

As a result of geophysical and geological surveys and diamond drilling in the late 1950's, Violamac Mines Limited brought the Kam-Kotia Mine back into production in 1961. Starting out as an open pit operation, the mine has now completely converted to underground production.

Exploration activity increased greatly in 1963-1964 with almost all of Robb and Jamieson Townships being staked. Numerous companies carried out airborne and ground geophysical surveys, geological mapping and diamond drilling. This increased interest resulted in the developemnt of two new copper-zinc mines by Canadian Jamieson Mines Limited and Jameland Mines Limited. The Canadian Jamieson Mine is located in northwestern Godfrey Township near the Jamieson boundary and started production in 1966. Shaft sinking is scheduled to commence in October, 1968 at the Jameland property in lot 11, concession III, of Jamieson Township.

At present, exploration activity has slackened with minor staking and some restaking taking place in 1968. Prospectors R. Allerston and E. Jutila worked on their claims during the summer. Mespi Mines Limited did line cutting and electromagnetic and magnetic work on their northeastern Jamieson Township claims, and line cutting and self potential surveys on their Jamieson copper claims. A small drill program was initiated in September on the northeastern group.

General Geology: All of the rocks with the exception of the north-south diabase dikes (Matachewan?) are Archean volcanics, sediments, gabbros and granites. The volcanics range from mafic to felsic in composition.

Mount Jamieson and areas of high relief to the north are underlain by mainly felsic flows, flow breccias, agglomerates and siliceous tuffs. North of the Kamiskotia River the magnetics and drilling indicate predominantly mafic metavolcanics and pyroclastics. The mafic rocks trend northwestward across northern Robb Township.

Drilling in southeast Jamieson Township indicates a southwest trending "Timiskaming-type" metasedimentary belt. To the north of this point and east of the Mattagami River the rocks appear to be predominantly mafic and then gradually become predominantly rhyodacitic and rhyolitic north of the line separating concessions III and IV.

Dioritic to gabbroic sills and lenses are numerous throughout Jamieson Township. Coarse-grained, banded gabbro and medium-grained granite dominate central Robb and southwestern Jamieson Townships.

Quartz and quartz-carbonate veins tend to become more numerous and contain higher temperature minerals near the granite and gabbro masses.

Structural Geology: The volcanics follow the circumference of the circular gabbro-granite intrusive centre located in Robb and Turnbull Townships. Isoclinal folding is evident and long wave-length cross folds are suggested.

West of the Mattagami River the regional schistosity strikes between east-west and N50°W and parallels the formations in the northwestern section of the area. Progressing southward, however, the schistosity crosses the formations at increasing angles.

Three separate fault systems were noted. Faults of the first system approx. parallel the volcanics and cut and displace the north-striking diabase dikes. Brecciation, silicification and carbonatization were noted along one such fault on the north side of Mount Jamieson. This same fault appears to be associated with the shear zone containing the Jameland orebodies. Faults of the second system trend north-south and parallel a fault with large left-hand displacement in the Mattagami River valley. Diabase dikes are mainly controlled by this system. Faults of the third system trend in a northeast direction and appear to displace the diabase dikes.

Economic Geology:

Kam-Kotia Porcupine Mines: Total production as of December 31, 1967, amounted to 87,359,563 lb. of copper, 35,748 tons of zinc concentrate, 294,666 oz. of silver and 2,299 oz. of gold[1]. The ore zones are composed of massive and stringer sulphides (pyrite, chalcopyrite, pyrrhotite, sphalerite) and are contained in north-dipping, sheared andesite, andesitic fragmental tuffs, rhyodacitic tuffs and agglomerates[2]. Chlorite and sericite alteration is associated with the zones. The zones as a group plunge westward.

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1 Canadian Mines Handbook, 1968-1969; Northern Miner Press.
2 Somerville, R., C.I.M.M. Centennial Field Excursion Guidebook, 1967.

Jameland Mines: The drill program which began work on the previously discovered (Dominion Gulf) sulphide zone in 1966, ended in 1968 and indicated 432,000 tons of 1.96% copper and 170,000 tons of 1.06% copper and 7.2% zinc[1]. The ore is contained in approximately 10 irregular shaped pods which plunge 30°-35°SE within a sheared sequence of interbanded andesite, rhyodacite, welded tuff and rhyolite. The zone strikes N63°W and dips steeply north. Wall-rock alteration effects and ore types are similar to those at the Kam-Kotia Mine. A 1200-foot shaft and 4 levels are planned by the company to develop the ore.

Other Occurrences: Numerous pyrite occurrences extend in a belt stretching from the area of the Jameland and Kam-Kotia Mines south-southeastward to the Canadian Jamieson Mine. Values in gold, silver, copper and zinc have been reported from quartz veins in the southwest corner of Jamieson Township.

Quartz veins on the E. Jurila claims on Mount Jamieson were noted. Assays of grab samples taken by Mr. Jutila from 2 zones within an 800-foot long vein contained gold values ranging from $4.00 to $10.50 per ton[2]. A 150-foot long zone containing 10% pyrite gave the highest values. Lower gold values and minor silver values were received from an 80-foot zone having a combined 5% chalcopyrite, sphalerite and galena content. This vein is 2 inches to 15 inches wide and is directly controlled by a prominent joint-fracture system that strikes N20°W and dips 75°W. Numerous smaller veins and veinlets branch off and parallel the main vein. These veins are barren or contain minor amounts of pyrite. The brittle felsic wall rocks occasionally contain high concentrations of pyrite. In the same claim group a 20-foot wide shear zone containing stringers of sphalerite, chalcopyrite and pyrite was noted. Trenching by Mr. Jutila indicates that the zone extends for more than 1000 feet in a north-northwest direction and may be related to the large fault structure mentioned under Structural Geology.

Sulphide and magnetite occurrences are abundant in the Robb Township gabbro.

No. 18 FALLON AND FASKEN TOWNSHIPS

DISTRICT OF TIMISKAMING

by

D. R. Pyke[3]

Location: The area mapped is approximately 25 miles southeast of Timmins and is most readily accessible either by helicopter or water. Access by water is via the Nighthawk and Whitefish Rivers for Fallon and Fasken Townships respectively. An all weather logging road extends west from Timmins and Michie

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1
2 Somerville, R., personal communication, Kam-Kotia Porcupine Mines Limited.
3 Jutila, E., gold values at $35 per ounce, personal communication.
Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

Townships, to the northeast corner of Fasken Township.

Mineral Exploration: United Buffadison Mines Limited holds a group of 14 unpatented claims in the northwest corner of Fasken Township, and in 1966 conducted magnetic, electromagnetic and soil sampling surveys. The soil samples, analysed for Cu, Pb and Zn, indicated a number of anomalous zones. In 1967, five holes, totalling 1305 feet, were drilled to test the geochemical anomalies. Only trace amounts of sulphide mineralization were encountered.

International Kenville Gold Mines Limited formerly held 24 claims in the northeast corner of Fallon Township. In 1965 five holes, totalling 1534 feet, were drilled to test various geophysical anomalies. Only traces of sulphides were found to be present.

Magoma Mines Limited is the only other Company to have carried out exploration activities for which assessment work is on file with the Ontario Department of Mines. This consisted of a magnetic and electromagnetic survey made in 1965 on one claim in the northwest corner of Fallon Township, as part of an exploration program on a large claim block in Langmuir Township to the north.

General Geology: Intercalated metamorphosed volcanic flows and pyroclastics constitute the oldest rocks in the area. These are predominantly of a basalt-andesite composition in the northern part of the area and dacite-rhyolite for a large portion of the central part of the area. In many cases the felsic volcanics appear to be fargely fragmental. However, relationships are often obscured by extensive epidote, quartz and feldspar veins and stringers, especially in close proximity to the intrusions.

An elliptical stock of massive to strongly foliated, fine- to medium-grained pink, porphyritic monzonite outcrops in the north-central part of Fallon Township. Extreme variations in texture, and to a lesser degree composition are common.

Coarse-grained, massive to weakly foliated granodiorite, averaging approximately 15 percent quartz and 8 percent mafic minerals, underlies the eastern portion of Fasken Township. Megacrysts of K-feldspar, averaging 0.4 inches in maximum dimension, are ubiquitous. In the extreme northeast corner of Fasken Township, a finer grained granodiorite, in which no megacrysts of K-feldspar were observed, is exposed. This finer grained intrusion appears to be separated from the coarse-grained granodiorite by a thin screen of sediments.

Relatively flat-lying sediments of the Cobalt Group were observed to unconformably overlie the volcanic rocks, and form an extensive area of high hills in the western part of Fallon Township.

Diabase dikes intrude all the rocks in the area.

Regional metamorphism is of the greenschist facies. Rocks of the albite-epidote and hornblende-hornfels facies are found in close proximity to the intrusions of monzonite and granodiorite.

Structural Geology: Northwest-striking faults are prominent; the Montreal River Fault extending across the central portion of the area is the most evident (Ontario Department of Mines Map 2046). Older, north-south faults, although not so evident, also are extensive.

In the northern part of Fallon Township the foliations in the mafic volcanics are seen to bend more or less in conformity with the boundary of the monzonite stock.

A few pillow-top determinations suggest the presence of an anticline, the axial trace of which trends west-northwest across the central portion of Fallon Township.

Economic Geology: Pyrite is common throughout many of the volcanic rocks, occurring mainly as disseminations but locally being more concentrated along narrow slip surfaces. Pyrite also occurs in a few quartz and quartz-carbonate veins, and in one pyrite-bearing vein in a trench near the Langmuir - Fallon boundary, minor galena was observed.

Two of the more interesting aspects regarding prospecting in the area are:
(1) Many of the volcanics lie within the contact aureole of either the monzonite or granodiorite, thereby being in a favourable position for hydrothermal mineralization related to the intrusions.
(2) Presence of an anticlinal structure in the felsic volcanics in the south-central portion of the area offers a possible structural control for mineral deposition.

No. 19 MOHER, SEMPLE AND HUTT TOWNSHIPS

DISTRICT OF SUDBURY

by

E. G. Bright[1]

Location: The map-area is approximately 32 miles south of Timmins and 25 miles northwest of Matachewan.

The southeast corner of Semple Township is about 5 miles north of the Sothman Mines nickel deposit of Falconbridge Nickel Mines Limited and Kirkland Minerals Corporation Limited; the southeast corner of Hutt, the township east of Semple is about 2 miles north of the former Midlothian gold mine of Stairs Exploration and Mining Co. Limited.

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[1] Resident Geologist, Ontario Department of Mines, 155 Pine St. South, Timmins, Ontario.

Access is provided from Matachewan by Highway 566 and Wicks' logging road, which extends across the northern part of Semple and Hutt. The area may also be reached by secondary roads from Timmins and Gowganda.

Mineral Exploration: Between 1925 and 1930, and later during the 1950's, the eastern part of Semple and most of Hutt Township were prospected intensively for gold. In 1962-1963, Hollinger Consolidated Gold Mines Limited carried out geophysical and drilling programs in northwestern Hutt and northeastern and southeastern Semple Townships.

Previous to this, in 1951-1952, the Dominion Gulf Company investigated the numerous ultramafic sills in Semple Township and the northeastern part of Hutt. A subsequent search for base-metal mineralization in the eastern part of Semple was made by Canadian Johns-Manville Co. Limited in 1957; and Mining Corporation of Canada (1964) Limited, and P.C.E. Explorations Limited in 1965.

In 1968, Daniel Mining Co. Limited, Probe Mines Limited and Spirit Lake Mines Limited carried out drilling programs in Semple Township. In 1967, Amax Exploration Incorporated made an airborne geophysical survey of the region. Several conductive zones, one near the southern boundary of Hutt Township and several others in northeastern Hutt and eastern Semple Townships were tested by diamond drilling.

General Geology: Semple and Hutt Townships are underlain by an easterly-trending belt of intercalated steeply dipping Archean volcanic and subordinate ultramafic-mafic intrusive rocks. Dacitic flows and pyroclastic rocks interstratified with subordinate andesitic, rhyolitic and basaltic lavas predominate in Hutt Township. The rhyolitic flows are most abundant in northeastern Hutt and in several places are associated with narrow lenses and zones of graphitic schist containing disseminated to massive pyrite with minor pyrrhotite-chalcopyrite. Andesitic rocks predominate in Semple, the township west of Hutt. Narrow interbands of dacitic lava and (sulphide) iron formation are present.

Sill-like bodies of peridotite, pyroxenite and gabbro are most numerous in central and southeast Semple and northeast Hutt. A late non-foliated porphyritic granite stock (the Mountjoy stock), which underlies most of Moher Township, intrudes the older Kapiskong granitic pluton in the western part of Moher and the still older Archean strata near the western boundary of Semple township. Minor granitic and quartz-feldspar porphyry dikes, probably related to the Mountjoy stock, are common in the central part of the map-area, a region of numerous faults and shear zones. The youngest rocks in the map-area are north-trending diabase dikes and younger northwest-and-northeast-trending diabase dikes.

Structural Geology: The Archean strata form part of an easterly trending belt of highly folded steeply dipping rocks in the north flank of the Halliday rhyolitic dome.[1] In the southern part of Semple and Hutt, the fold pattern

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[1] Bright, E.G., 1968: Geology of Halliday and Midlothian Townships; Ontario Department of Mines, Open File Report No. 5018.

parallels the east-trending northern flank of this rhyolitic dome, but in the northern and northeastern parts of these townships major displacements along normal, cross and two thrust faults disrupt the older easterly trend of the folded strata.

The Mountjoy granite stock, a large structural dome, intrudes this easterly trending belt of volcanic rocks near the Moher-Semple boundary and superimposes a younger northerly trend on the older fold pattern.

In addition to the numerous cross and normal faults in the map-area, there are two major northwest-trending thrust faults in the northwestern part of Hutt Township. These thrust faults have strongly sheared, dragfolded and displaced the previously folded strata.

Economic Geology:

Asbestos: The better occurrences of cross-fibre asbestos noted were in the crescent-shaped ultramafic sill in the central part of Semple Township. In one drillhole put down by the Dominion Gulf Company in 1952 near the western end of the northern limb of this folded intrusive body, a fibre count[1] from 10 to 281 feet showed 404 veinlets with a width of 1/32 inch, 39 with a width of 1/16 inch and 4 with a width of 1/8 inch. A drillhole put down by Daniel Mining Company Limited in 1968 near the nose of this westerly plunging synclinally folded ultramafic sill showed a 37-foot section of core with a fibre count[1] of 2 with a width of 1/4 inch and 22 with a width of1/16 inch.

Copper: Minor chalcopyrite is associated with disseminated to massive pyrite and subordinate pyrrhotite:

1) In several places throughout Hutt Township where zones of graphitic schist and slate are intercalated with fragmental dacitic and rhyolitic rocks.
2) In Semple Township, in the narrow interbeds of (sulphide) iron formation near the eastern margin of the Mountjoy granite stock; and in several of the dacitic tuffaceous interbeds near or adjacent to the ultramafic sills.

Gold: Trace amounts of gold are present in some of the quartz veins, stringers and localized stockworks cutting the numerous granitic dikes present in the region between the Redstone River and Canoeshed Lake. In the northeast part of Semple, east of the Redstone River, reported assays from the former Alford-McCall gold showing (Hollinger Consolidated Gold Mines Limited, 1962) ranged from 0.04 oz. gold per ton across a width of 8 feet to 0.44 oz. gold per ton over 9 inches (The Northern Miner, Dec. 29, 1949).

Molybdenite: A quartz vein, containing disseminated molybdenite was found approximately 1/4 mile west of North Moher Lake in Moher Township. The vein ranges from 3 to 12 inches wide and is exposed for about 20 feet along strike. Disseminated molybdenite was observed over a strike length of about 10 feet both in the vein and in the immediately adjacent metavolcanic-granitic wallrocks.

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[1] Files, Resident Geologist's Office, Ontario Dept. Mines, Kirkland Lake, Ont.

Nickel: In the central part of Semple Township, near the nose of the large crescent-shaped ultramafic sill, a drillhole bored by Mining Corporation of Canada (1964) Limited in 1965 averaged approximately 0.26 percent nickel for 425 feet[1]; locally assays ranged from 0.35 percent nickel over a core length of 10 feet to 0.41 percent nickel over a core length of 10 feet.

No. 20 MELBA AND BISLEY TOWNSHIPS

DISTRICT OF TIMISKAMING

by

L. S. Jensen[2]

Location: The map-area, about 10 miles north of Kirkland Lake, is readily accessible by water, by float-equipped aircraft, and by roads extending from Kirkland Lake and from Highways 11 and 66.

Mineral Exploration: After World War 1, prospectors fanning out from Kirkland Lake explored the map-area for gold. In 1937 a two-compartment inclined exploratory shaft was sunk 246 feet on the property of Pitchvein Mines Limited. Work by the previous and present owners also consisted of 2,000 feet of lateral development, several hundred feet of surface trenching, and more than 8,000 feet of diamond drilling. No production resulted.

More recent activity has been in search of base metal sulphide deposits in the volcanic rocks. Several copper occurrences were found, and explored by shallow shafts, geophysical tests, and diamond drilling.

In recent months, various individuals and companies have examined the Munro Esker in the eastern portion of the map-area, in search of kimberlite occurrences indicated by placer concentrations of pyrope garnets.

General Geology: In the map-area, a large belt of metavolcanic rocks of Archean age predominates. The belt consists of mafic to felsic units composed of massive, pillowed, and fragmental bands from 20 to 300 or 400 feet thick. One interbedded unit of metasediments (graphitic slate, chert, and greywacke) occurs in the belt, partly on the Pitchvein gold property. Gabbroic to dioritic sills and other bodies cut the volcanic rocks.

Dikes of mafic syenite and feldspar prophyry cut the volcanic and sedimentary units of the volcanic belt.

A few "Matachewan" diabase dikes occur in the map-area.

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[1] Files, Resident Geologist's Office, Kirkland Lake, Ontario.

[2] Post-graduate student, Department of Geology, University of Saskatchewan, Saskatoon, Sask.

Several eskers of Pleistocene age trend southeast and south across the map-area.

Structural Geology: The volcanic rocks are part of a synclinorium plunging eastward across the area, the south limb of which contains minor folds trending S20°E.

East, northwest, and north-trending normal faults were found. The east-trending faults cut the north limb of the synclinorium, and are associated with much shearing. Northwest-trending faults are parallel to the minor folds in the south limb. The north-trending faults are sinistral, and some are intruded by diabase.

Economic Geology: Gold was discovered on the property of Pitchvein Mines Limited in the early 1930's. The gold is in quartz veins and associated feldspar porphyry dikes cutting Archean volcanic and sedimentary rocks. Gold assays as high as 2.05 oz. per ton were reported, with local pockets of copper and zinc.

Chalcopyrite occurs in six separate localities in the volcanic rocks, in quartz-carbonate veins and stringers filling minor fracture systems of diverse trends.

Massive pyrite occurs in pillow selvages and fractures in the volcanic sequences, and pyrite nodules are contained in the sedimentary bands.

As well as the Munro Esker, other eskers should be explored in an effort to discover additional indications of kimberlite, which can be expected near the long deep faults of the area.

No. 21 OTTO TOWNSHIP

AND THE NORTHERN PART OF MARQUIS TOWNSHIP

DISTRICT OF TIMISKAMING

by

H. L. Lovell[1]

Location and Access: Otto is the township south of Teck, in which Kirkland Lake and Swastika are situated. Marquis is the township south of Otto. Highways 11 and 112, and concession, lot line, and logging roads provide excellent access. Electric power transmission lines, the Trans-Canada natural gas pipeline and its branch to the Adams iron mine of Jones & Laughlin Mining Company Limited, and the Ontario Northland Railway pass through the township.

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[1] Resident Geologist, Ontario Department of Mines, 4 Government Road E., Kirkland Lake, Ontario.

Mineral Exploration: The belt of volcanic and sedimentary rocks in the northern part of Otto Township was prospected mainly for gold, and most of the work was done before 1950. Limited prospecting, geophysical surveying, and diamond drilling have been done on small areas of the large zone of iron formation bordering the northern contact of an alkalic igneous stock. The stock itself, which occupies the southern two-thirds of Otto Township, is relatively unexplored.

General Geology: All bedrock in the map-area is thought to be Precambrian in age. From oldest to youngest, the rocks are: Keewatin-type sedimentary rocks; massive and gneissic granitic rocks of the Round Lake batholith; an alkalic igneous complex; and Matachewan-type mafic intrusive dikes.

Earlier maps show the Round Lake batholith in contact with the Otto Township alkalic igneous stock; actually they are separated by a belt of Keewatin-type rocks about one-half mile wide. Also, the youngest felsic intrusive rocks in the Kirkland Lake area were thought to be Algoman in age, such as the Round Lake batholith, the age of which was determined by Aldrich and Wetherill[1] to be 2.55 $\pm$ 0.13 billion years (Rb/Sr). The Otto stock was thought to be an offshoot of the Round Lake batholith, but in 1967 Purdy and York[2] determined the age of the stock to be 1.73 $\pm$ 0.05 billion years (Rb/Sr whole rock). This is about the same age as some carbonatite intrusions in northeastern Ontario[3], and the Sudbury norite-micropegmatite[4].

Structural Geology: The Keewatin-type rocks are closely folded, with the trend of the folds making a roughly circular pattern around the (circular) contact of the Otto Township alkalic igneous stock.

Strong faults and lineaments strike northeast and northwest, and joint patterns in the Otto stock are distinct.

In Otto Township, concessions III and IV, lots 2 and 3, a ring-like feature 3,500 feet in diameter lies inside the contact of the Otto stock. This feature might mark the location of a younger stock, or the junction of several joints or faults.

Economic Geology: Long narrow lenses of iron formation (banded magnetite and chert, as well as pyrite-pyrrhotite-graphite zones) are interbedded with tuff and agglomerate of rhyodacitic and andesitic composition. Most of the sulphide zones are barren, but some contain low percentages of copper, zinc, and nickel. Because electromagnetic and magnetic anomalies are widespread in the iron formation, and the parts containing base metals do not cause the highest anomalies, drilling, most of which is based on geophysical work, has so far proved disappointing. However, surface prospecting, soil and bedrock geochemistry, and greater use of geology during interpretation of geophysical work would provide more rewarding drill targets.

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1 Aldrich, L.T., and Wetherill, G.W., 1960: Jour. Geophys. Research, Vol.65, p. 337-340.

2 Purdy, J.W., and York, D., 1968: Canadian Jour. Earth Sciences, Vol. 5, p. 699-705.

3 Gittins, J., McIntyre, R.M., and York, D., 1967: Canadian Jour. Earth Sciences, Vol. 4, p. 651-655.

4 Fairbairn, H.W., Faure, G., Hurley, P.M., and Pinson, W.H., Jr., 1964: Jour. Geology, Vol. 72, p. 848-854.

In places, metamorphosed contact rocks and inclusions in the Otto stock consisting of biotite, pyroxene, and amphiboles, contain small amounts of disseminated bornite or are cut by a few carbonate stringers containing chalcopyrite.

Exploration for gold should be concentrated in the two northern concessions of Otto Township, in the syenite, trachyte, and carbonate rocks, which are the host rocks of the gold mines of Matachewan, Kirkland Lake, and Larder Lake.

In at least three places near the contact of the Otto stock, the syenite contains nepheline. The largest known body trends northwest along the Ontario Northland Railway siding that is one-half mile north of the community of Dane. This body is 800 feet wide and almost one mile long, and contains a wide range of concentrations of nepheline.

No. 22 GOWGANDA AREA (HAULTAIN AND VAN HISE TOWNSHIPS)

DISTRICT OF TIMISKAMING

by

W. H. McIlwaine[1]

Introduction: Part of the 1968 field season was spent completing the mapping of the Gowganda area. This work involved the completion of Haultain Township and the mapping of Van Hise Township. Previously released maps of the area include Nicol (P.374) and Milner (P.475) Townships.

Location: The village of Gowganda, which is the centre of the map-area, is approximately 50 miles west-northwest of Cobalt. The area can be reached by unpaved Highway 560 from Elk Lake, 26 miles to the east, and from the highway numerous lakes provide access to all parts of Van Hise and Haultain Townships.

Mineral Exploration: Much of Haultain Township has been subjected to intensive prospecting for silver as is evidenced by the numerous prospect pits and shafts. Van Hise has also been prospected, but to a lesser degree. Sisco Metals of Ontario Limited in 1968 did geological mapping and geochemical sampling on their claim group in the northern part of Van Hise Township and normal mining and milling operations continued at their main mine in Haultain and Nicol Townships. This latter work also included mining and underground exploration on the ground leased from McIntyre Porcupine Mines Limited, which includes the past producing Castle-Trethewey and Capitol Mines.

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[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

General Geology: The oldest rocks are Archean, massive to schistose, intermediate to mafic metavolcanic flows and tuffs. They occur in three main areas: southwest Haultain Township; an east-west, one-half mile wide belt across central Haultain Township; and a larger area in south-central Van Hise Township.

Intruding the metavolcanic rocks on the east shore of Firth Lake in Van Hise Township is a small body of medium-grained Archean metagabbro. On the south shore of Serpentine Lake and through to Firth Lake is a small area of fine-grained serpentinite.

To the north of the volcanic and mafic intrusions is an extensive area of granitic rocks. The granite in the eastern portion of the area appears to be recrystallized and is generally a coarse-grained, white biotite or hornblende granite. To the west, and including all the granitic rocks of Van Hise Township, is a more uniform pink hornblende granite.

North-striking Matachewan-type diabase dikes intrude all the above described rocks.

Unconformably overlying the Archean basement rocks are flat-lying sedimentary rocks of the Huronian Cobalt Group, with the Coleman and Lorrain Formations present. The Coleman Formation consists mainly of fine-grained greywacke, quartzose siltstone, arkose, conglomerate and breccia. The Lorrain Formation is mainly arkose and quartzite and is preserved in a downfaulted block striking north approximately along the Van Hise - Haultain boundary.

The Nipissing Diabase intrudes all older rocks. The main area is in southern Haultain Township where the northern part of the Miller Lake diabase basin occurs; most of the silver production of the area has come from this diabase basin. The diabase extends north through the township in a belt one to two miles wide. Several areas of diabase are also found in Van Hise Township. The diabase is a quartz diabase, with several small areas of granophyre ("red-rock") west of Lost and Wigwam Lakes in southeastern Haultain Township.

Several northeast-trending Abitibi-type (Fahrig et al. 1965)[1] diabase dikes also occur.

Structural Geology: Foliation in the metavolcanic rocks has an easterly strike and dips steeply. Bedding in the Cobalt Group sediments is generally flat with an easterly regional dip.

Numerous regional north-striking faults, with downthrown west sides, are present. These faults include those striking through Lost Lake and Bloom Lake, Dinny Lake to Davidson Lake, along Obuskhong Lake, along Mackintosh Creek, through Firth Lake and two more to the west of Firth Lake.

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[1] Fahrig, W.F., Gaucher, E.H., and Larochelle, A., 1965: Palaeomagnetism of diabase dykes of the Canadian Shield; Canadian Jour. Earth Sciences, Vol. 21, p. 278-298.

Economic Geology: Native silver with associated cobalt and nickel arsenides are the major economic minerals in the area. They are found in carbonate veins, mainly calcite, filling fractures in the Nipissing Diabase, which has hosted nearly all of the silver produced in the Gowganda camp. Minor amounts have been found in metavolcanic rocks, as in the Lower Bonsall Mine.

Following is a list of the producing and past-producing mines of the Gowganda area, giving the total production in ounces of silver and dollar value for each mine and the area as a whole.

Producing and Past-Producing Mines, Gowganda Area[1]

Mine	Township	Total Ounces of Silver	Total Dollar Value
Bonsall	Haultain	10,406	6,168
Capitol	Haultain	10,837,181	9,830,988
Castle-Trethewey	Haultain	6,461,021	3,672,760
Millerett	Haultain	611,822	305,581
Wigwam	Haultain	896	584
Miller Lake O'Brien (Siscoe)	Nicol	37,987,767	29,893,278
Morrison	Nicol	719,201	484,288
Walsh	Nicol	453,424	254,480
Bartlett	Milner	20,219	21,316
Boyd-Gordon	Milner	4,678	2,532
Mann	Milner	98,792	56,733
Reeve-Dobie	Milner	88,584	54,123
Welch	Milner	1,000	540 (est)
Totals		57,294,991	$ 44,582,831

[1] Statistical Files, Ontario Department of Mines.

No. 23 LEITH - CORKILL AREA

DISTRICT OF TIMISKAMING

by

W. H. McIlwaine[2]

Location: The Leith - Corkill area consists of the townships of Leith, Charters and Corkill. The centre of the area is approximately 9 miles south of Gowganda and 50 miles west-northwest of Cobalt. Road access in the area is provided by the road off Highway 560 to the property of Rustex Mining Corporation in southeastern Leith Township. A lumber road branching from this provides access to southeastern Corkill Township. Access to the remainder of the area is by water.

[2] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

Mineral Exploration: Silver was first discovered in 1908 by Dan O'Gorman on what is now the property of Rustex Mining Corporation, and the following year Hugh Kell discovered the Kell Silver Mine in southwest Corkill Township. Small prospects have been worked in Charters Township where some pitting and trenching have been done. From 1910 to 1913 four shafts were sunk on the Rustex property but production was reported only for the years 1936 to 1938[1] and 1964 to 1966. During these six years a total of 80,186 ounces of silver and 565 pounds of cobalt were produced. The Kell Mine is reported to have yielded 1,620 ounces of silver. Ourgold Mining Company Limited, the present owners of the Kell Mine, did diamond drilling in 1966. Rustex was on stand-by during the summer of 1968 keeping the main No. 3 shaft dewatered.

General Geology: Archean rocks in the map-area are exposed by two small windows in the overlying Huronian sedimentary rocks. One of these, on the west shore of Elkhorn Lake, in north-central Leith Township, is composed of intermediate to mafic metavolcanic flows, tuffs and agglomerates, and the other is composed of granitic rocks which are exposed in the northwest corner of Corkill Township. Both of these areas are intruded by north-striking Matachewan-type diabase dikes.

Unconformably overlying the Archean basement rocks are Huronian sediments. The Coleman Formation, consisting of fine-grained greywacke, quartzose siltstone and sandstone, arkose and conglomerate, underlies nearly all of Leith Township. Almost all of Charters and Corkill Townships are underlain by quartzite, feldspathic quartzite and arkose of the Lorrain Formation.

Intruding the above rocks is the Nipissing-type diabase. In Leith Township the diabase is in the form of a sill dipping 5-10°E. Diabase is also present in southern Charters Township. In Corkill Township a wide northerly trending dike-like body of diabase dips 55-60°E. On the basis of aeromagnetics this diabase is inferred to extend the full length of the township. Local areas of granophyre ("red rock") were found west of the Wapus Creek in the northwest corner of Leith Township. Several northeast-trending diabase dikes in Leith Township are considered to be of the Abitibi type[2].

Leith Township has the greatest amount of outcrop; exposures in Charters and Corkill Townships are scattered owing to thick overburden, which is mainly rolling sand hills, and sand plains.

Structural Geology: Foliation in the metavolcanic rocks is generally dipping steeply to the southwest. Bedding in the Huronian sediments is gentle with a regional dip to the east southeast. Faulting in the area is deduced mainly from aerial photographic lineaments which are predominantly north-south.

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[1] Figures from statistical files, Ontario Department of Mines.

[2] Fahrig, W.F., Gaucher, F.H., and Larochelle, A., 1965: Paleomagnetism of diabase dykes of the Canadian Shield; Canadian Jour. Earth Sciences, Vol. 21, p. 278-298.

Economic Geology: Native silver, with associated nickel and cobalt arsenides, is the main type of mineralization found. The mineralization is in a gangue of carbonate and quartz-carbonate which fills fractures in the diabase. Aplite dikes are also associated with mineralization in the Rustex Mine. In both of the mines (Kell and Rustex) high grade ore has been found at the intersections of a main vein system and crosscutting minor veins.

In the main fracture at the Kell Mine a calcite-quartz vein up to 18 inches wide extends northwest over several claims on the footwall contact of a northwesterly-striking diabase dike. From an open pit south of the shaft 1,584 pounds of ore yielded 1621 ounces of silver[1].

At the Rustex Mine the main vein system has been drifted along for approximately 1200 feet on two levels. The calcite vein is reported to vary from 1 to 6 inches in width.

No. 24 GRIGG AND STOBIE TOWNSHIPS

DISTRICT OF SUDBURY

by

H. D. Meyn[2]

Location: Grigg and Stobie Townships are located approximately 40 miles NNE of the City of Sudbury or approximately 15 miles north of Lake Wanapitei. Access is provided by private lumber roads branching from Highway 545, and float-equipped aircraft.

Mineral Exploration: Mineral exploration in the area had been carried out during the last few summers for uranium occurrences at the base of the Huronian system. The Canadian Johns-Manville Company Limited carried out extensive airborne and ground geophysical and geological surveys and some diamond drilling in the 18 months previous to this summer's field season.

General Geology: The area is underlain by Precambrian rocks of various ages with a discontinuous cover of Pleistocene to Recent deposits of sand, gravel, and clay.

Older metavolcanic and possibly metasedimentary schists and mafic intrusive rocks are intruded by granite with numerous pegmatites. These rocks are found on the west side of Grigg Township, in the northeast corner of Grigg Township, and the northwest of Stobie Township.

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[1] Sergiades, A.O., 1968: Ontario Dept. Mines, Mineral Resources Circular No. 10, p.372.

[2] Geologist, Ontario Dept. Mines, 1349 LaSalle Blvd., Sudbury, Ontario.

The above rocks form the basement on which a sequence, possibly up to 10,000 feet thick, of Huronian sedimentary rock have been deposited. The contact with the basement is faulted and sheared in many places.

In the part of the Huronian belt in Grigg Township that parallels the Wanapitei River, 6000 feet in outcrop width (3000 feet true thickness) of Bruce Group sediments are exposed below those of the Cobalt Group. The exposure of Bruce Group rocks diminishes where the contact turns east and northeast in northern Grigg and Stobie Townships. Here the sediments of the Bruce Group appear to be confined to 150 feet below the Gowganda Formation of the Cobalt Group and the contact appears to be gradational. The Huronian sequence has been intruded by very large bodies of mafic intrusive rocks (Nipissing-type gabbro). The youngest rocks in the area are long, narrow, west-northwest-trending dikes of olivine diabase of probably Keweenawan age.

Structural Geology: Minor structures are poorly developed in these rocks. Schistosity is sometimes well developed in some of the metavolcanic-metasedimentary sequence and to a minor degree in the soft Gowganda argillite. Gneissosity is almost absent in the granites. Jointing occurs in a few places in the granite and the gabbroic rocks. Lineations are very scarce.

The whole area has undergone some folding and a period of block-faulting. The major fault of the area is the Upper Wanapitei Fault. The faulting has disturbed but not completely obliterated the basic structure of a basin of Huronian sediments with its centre to the southeast of the map-area.

Economic Geology: Uranium occurrences were found in rocks of the Mississagi Formation at the base of the Huronian sequence. These were extensively investigated by the Canadian Johns-Manville Company Limited.

No showings of minerals of economic interest were found by the field party. The argillite of the Gowganda Formation carries as much as 5 percent detrital magnetite and cubes of pyrite are found in the massive Gowganda greywacke. Very minor amounts of sulphides are found in certain places in all the rocks of the map-area, especially near shears, faults, and igneous contacts.

No. 25 BURWASH AREA

DISTRICTS OF SUDBURY, NIPISSING, AND PARRY SOUND

by

S. B. Lumbers[1]

Location: The Burwash area, covering about 1700 square miles in the northwestern part of the Grenville Province of Ontario, is bounded by latitudes 46°00' and 46°30', and longitudes 80°00' and 81°00'. Mapping of this area on a scale of 1 inch to 1 mile was started in 1967, and during

[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

the 1968 field season, mapping was completed of all but a small portion in the western half of the area.

Mineral Exploration: Deposits of copper, nickel, allanite, apatite, nepheline, corundum, graphite, feldspar, mica, kyanite, silica, industrially useful rocks, and sand and gravel have been explored and utilized within the Burwash area. Present production is confined to sand and gravel.

General Geology: The Grenville front, a tectonic zone separating rocks of the Grenville Province from those of the Southern and Superior Provinces, cuts across the northwest corner of the area about 7 miles southeast of Sudbury. In the area, the Grenville Province is underlain mainly by a metamorphic complex of orthogneiss and paragneiss regionally metamorphosed to the middle and upper almandine amphibolite facies, whereas to the northwest in the Southern Province the rocks consist mainly of low metamorphic grade metasediments intruded by gabbroic and minor granitic bodies. The main geological features of the eastern half of the Burwash area were described previously[1]. Metasediments form over half of the metamorphic complex of the Grenville Province and are mainly biotite gneiss derived from feldspathic sandstones and quartzo-feldspathic gneiss derived from arkosic sandstones. Metamorphosed shale and conglomerate are present locally, especially in the western half of the area, and several units of orthoquartzite and quartzose gneiss are present in the western third of the area. Calc-silicate gneiss derived from calcareous shale and siltstone commonly is interlayered with the sandy metasediments, but except for two occurrences in the northwestern part of the area, marble is unknown. Most of the quartzo-feldspathic and biotite gneisses contain sodic and potassic feldspars and less than 45 percent quartz, and are migmatitic with at least 10 percent veins and discontinuous layers of granitic material. Where they are rich in calcic feldspar (20 percent anorthite), however, they are commonly non-migmatitic. Orthoquartzite, quartzose gneiss, and calc-silicate gneiss also are generally non-migmatitic. This indicates that the development of migmatite in the metasediments took place during regional metamorphism and was controlled, at least in part, by the bulk composition of the original sedimentary rock.

A large variety of plutonic rocks were emplaced within the metasedimentary gneisses prior to the culmination of regional metamorphism. Anorthosite and anorthositic gabbro forming small, sheet-like bodies are among the oldest plutonic rocks. One anorthositic body south of Hartley Bay in Allen Township contains abundant late syenite as dikes and irregularly shaped bodies, but in anorthosites elsewhere in the area, syenitic phases are either rare or absent. Batholithic masses of granitic rocks are present in the southwest, south-central, and eastern parts of the area, and small sill-like bodies and relatively thin sheets of granitic rocks are found throughout the area. Most of the granitic rocks are gneissic and migmatitic quartz monzonite, but gneissic granodiorite and trondhjemite are present and form one batholith centred in Cosby Township. In the southwestern part of the area, many of the granitic rocks could be older than small bodies of syenitic and dioritic rocks found mainly in the central part of a regional, southeasterly plunging synform whose axis passes through central Servos, eastern Cox, and western Bigwood Townships.

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[1] Lumbers, S.B., 1967: Ontario Dept. Mines, Misc. Paper 11, p. 68-71.

Within this structure in Bigwood Township, an elongated mass of gneissic nepheline syenite and alkalic syenite is intrusive into gneissic granitic rocks.

Amphibolite dikes are found both in the metasedimentary gneisses and in the plutonic rocks, and in the gneisses within about 12 miles of the Grenville front in the northwestern part of the area, metagabbro sills become increasingly abundant. Within about 6 miles of the front, several ages of plutonic rocks are present, among which are two ages of late diabase and two distinct generations of pegmatite dikes. Dill, Cleland, Dryden, Awrey, and Hagar Townships contain small elliptical-shaped bodies of late diabase and rare intrusions of late pyroxenite and peridotite, all generally less than 1/4 mile across. Although a variety of igneous bodies are present in the Grenville front zone, only one mass has been traced across the front into the Southern Province. This mass, a granitic batholith which extends southwestward from Tilton and southeastern Broder Townships beyond the map-area, is older than the culmination of regional metamorphism in the Grenville Province.

Elsewhere in the metamorphic complex, late pegmatite dikes are widespread, particularly north of Highway 17 in Ratter and Hugel Townships. Late diabase dikes occupy east-west to northwest lineaments throughout the area and are particularly abundant in the French River region. A few, late, lamprophyre dikes north of Northwest Bay, Lake Nipissing, could be related to late alkalic intrusions present to the east in the North Bay area[1].

Structural Geology: Except in the northwestern and extreme western parts of the area, major structural trends shown by rocks of the Grenville Province are north to northwest, but in places, these rocks are deformed into complex dome and basin structures suggestive of two or more periods of major deformation. Both the orthogneiss and paragneiss show southeasterly plunging lineations which become more intense towards the west and northwest where the structure is dominated by the tectonic zone separating the Grenville and Southern Provinces.

Study of this tectonic zone is incomplete, but within 12 miles of this zone, the north to northwest structural trends are modified to northeasterly trends, possibly in part by compression and flowage of the Grenville gneisses against the relatively rigid Southern and Superior Provinces to the northwest. This change in regional structure is gradational over distances up to one mile and is accompanied by zones of mylonite gneiss. The Grenville gneisses commonly are separated from lower metamorphic grade rocks of the Southern Province either by faults, or by prominent lineaments. Nevertheless, mylonitization and the penetrative southeasterly plunging lineation extend up to four miles into rocks of the Southern Province. These relationships along the tectonic zone are complicated by late easterly to northeasterly faulting which displaced metamorphic and structural zones. Southeast of Coniston in Neelon Township and in Dryden Township, the mylonitization, penetrative southeasterly plunging lineations, and the Grenville gneisses are cut off abruptly by the northeasterly trending Wanapitei fault zone. Late pegmatite dikes found in the tectonic zone occupy fractures trending

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[1] Lumbers, S.B., 1968: Ontario Dept. Mines, Prelim. Map No. P.381.

perpendicular to the foliation of gneisses in the zone. The fact that intrusive rocks of ultramafic to felsic composition and of various relative ages are abundant in this tectonic zone suggests that the zone reflects a long and complex history.

Economic Geology: Granite pegmatite dikes in Hugel, Ratter, Dryden, Dill, Cleland, Burwash, and Servos Townships have been quarried for feldspar and mica. Many of these pegmatites in the northwestern part of the area are zoned, with quartz-rich cores and feldspar-rich margins, and a few contain radioactive minerals, chiefly allanite. The most radioactive dikes are characterized by abundant hematite staining which produces a brick-red colour in the feldspars. A pegmatite dike exposed in a cliff on the main channel of French River in southwestern Bigwood Township contains abundant allanite.

Small concentrations of specular hematite and minor magnetite as disseminated grains and massive veinlets are present in a quartzo-feldspathic gneiss - orthoquartzite sequence exposed between Eighteen Mile Bay and Dodd Lake in Delamere, Cosby, and Mason Townships. Minor concentrations of hematite were found in similar sequences elsewhere in the area so that such sequences should not be overlooked for possible concentrations of iron. Some of the orthoquartzite units in the western part of the area have been quarried for silica.

The variety of igneous rocks and structures present in the tectonic zone separating the Grenville and Southern Provinces, and particularly the occurrence of late ultramafic bodies, suggest that this major structure should be examined carefully. Several kyanite-rich gneiss units have been prospected within this zone and ultramafic bodies have been used in local road construction.

Many of the gneisses of the metamorphic complex, particularly the granitic rocks, could be possible sources of building stone. Rocks of the granitic mass in Delamere and Cosby Townships contain large grains of feldspar and garnet porphyroblasts and have a striking appearance when polished.

There are several magnetically anomalous zones within the Burwash area, some of which have been discussed previously[1]. Numerous diabase dikes near the French River in the southern part of the area produce marked east-west magnetic anomalies[2,3] and the quartzo-feldspathic gneiss - orthoquartzite sequence exposed between Eighteen Mile Bay and Dodd Lake in which small concentrations of iron oxides were found is magnetically anomalous[4].

Late diabase dikes, quartzose metasediments, and metagabbro underlie a magnetically anomalous area southwest of Millerd Lake in Tilton and Halifax Townships[5], but other anomalies along the western boundary of the area south of Highway 637[4] have not been examined.

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1 Lumbers, S.B., 1967: Ontario Dept. Mines, Misc. Paper 11, p. 68-71.
2 Geol. Surv. Canada, Geophysics Paper No.1499, published 1965.
3 Geol. Surv. Canada, Geophysics Paper No.1509, published 1965.
4 Geol. Surv. Canada, Geophysics Paper No. 1509, published 1965.
5 Geol. Surv. Canada, Geophysics Paper No. 1510, published 1965.

No. 26 INDUSTRIAL MINERAL RESOURCES OF THE HAMILTON AREA

by

D. F. Hewitt[1]

A survey of industrial mineral resources of the Hamilton topographic sheet was completed. Industrial mineral commodities produced in the area include stone, sand and gravel, and clay products. With the urban encroachment on the outlying areas in the vicinity of Toronto and Hamilton, it has become increasingly difficult to develop essential deposits of construction materials due to zoning restrictions and competition for land use. It is essential that an inventory of mineral resources in the areas adjacent to Hamilton and Toronto be made in order to help in guiding planning and land zoning in these areas.

Location: The Hamilton area comprises the Hamilton National Topographic Sheet (30 M/5) between latitudes 43°15' and 43°30'N and longitudes 79°35' and 80°00'W.

Geology: In the Oakville area in the east part of the sheet, the contact between the Queenston and Meaford Shale is exposed. Most of the eastern part of the sheet from Lake Ontario to the base of the Niagara Escarpment is underlain by Queenston Shale. The Niagara Escarpment extends through the western part of the sheet from Dundas through Waterdown and Mount Nemo to Milton. The lower part of the escarpment is composed of rocks of the Cataract and Clinton Groups. The only commercially important formation in these groups is the Whirlpool Sandstone, a building stone formerly quarried at Waterdown. The caprock of the Niagara Escarpment on this map sheet is the Amabel Dolomite from Waterdown to the north, and the Lockport Dolomite from Waterdown south.

Much of the area is mantled by thick Pleistocene and Recent deposits of clay, till, sand and gravel. The ancient beach of Lake Iroquois crosses the area from southwest to northeast. A large kame southwest of Rattlesnake Point is a source of sand and gravel. Kame gravels are also worked in the Campbellville area.

Economic Geology: Queenston Shale is quarried for the manufacture of brick, tile and sewer pipe by Diamond Clay Products Limited, Natco Building Products Limited and National Sewer Pipe Limited. Good sections of Queenston Shale with little overburden are available in the Oakville area west of the Lake Iroquois beach.

The Amabel Dolomite is quarried by Nelson Crushed Stone Division of King Paving & Materials Limited on Mount Nemo. The Lockport Dolomite is quarried near Dundas by Canada Crushed & Cut Stone Limited. These are the largest quarries in Ontario.

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Sand and gravel pits are operated at Campbellville and southwest of Rattlesnake Point.

No. 27 INDUSTRIAL MINERAL RESOURCES OF THE BOLTON AREA

by

D. F. Hewitt[1]

A survey of industrial mineral resources of the Bolton topographic sheet was completed. This is one of a series of industrial mineral resource studies in the Toronto-Hamilton area. Industrial mineral commodities produced in the area include building stone, sand and gravel.

Location: The Bolton area comprises the Bolton National Topographic Sheet (30 M/13) located between latitudes 43°45' and 44°00'N and longitudes 79°30' and 80°00'W.

Geology: In the area between Ebenezer and Tullamore in the south-central part of the sheet there are extensive outcrops of Meaford-Dundas Shale in the creek bottoms. Some sparse outcrops of Meaford-Dundas Shale may be seen at Woodbridge in creek valleys near Highway 7. Most of the western half of the sheet to the base of the Niagara Escarpment is underlain by Queenston Shale. For the most part it is covered by a thick mantle of Pleistocene drift, but there are outcrops along the base of the Niagara Escarpment from Cheltenham to Credit Forks. There are other outcrops of Queenston Shale north of Mono Mills. The formations of the Clinton and Cataract Groups outcrop sparingly in the face of the Niagara Escarpment. The most prominent formation of these groups is the Whirlpool Sandstone which outcrops in the Inglewood-Credit Forks area. The caprock of the Niagara Escarpment, which runs up the western side of the map-area, is the Amabel Dolomite. This formation outcrops sparingly and in Caledon Township is largely drift-covered.

Most of the map-area is mantled by thick Pleistocene deposits of clay, till, sand and gravel. The eastern half of the map-area is largely covered by till, except in the north where there is an area of the Oak Ridges kame moraine. At the extreme east-central edge of the map in the vicinity of Maple there is a sandy outwash tongue of the Oak Ridges moraine supporting several sand and gravel pits. In the lower part of the Humber valley there are deposits of deltaic and lacustrine sands. Some alluvial gravels along the river have been worked on a small scale.

The southeast half of the west half of the map-area is largely covered by till. The northern and central parts of the west half are occupied by ice contact stratified drift of the Oak Ridges moraine flanking and largely masking the edge of the Niagara Escarpment. There are two glacial spillways in the northwestern part of the area. One extends southeast through Mono Township to Sleswick where it swings southwest through Caledon Township to

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[1] Chief, Industrial Minerals Section, Ontario Department of Mines, Parliament Buildings, Toronto.

Caledon. This spillway is an important source of gravel and sand. The second spillway extends from Albion almost to Inglewood.

Economic Geology: The Queenston Shale was formerly quarried at Cheltenham just south of the map-area for the manufacture of brick. Extensive outcrop areas of Queenston Shale suitable for manufacture of brick and tile may be found in the Cheltenham-Inglewood area and in Mono Township.

The Whirlpool Sandstone is intensively quarried in a 2-mile long belt along the base of the Niagara Escarpment southwest and west of Inglewood.

The Amabel Dolomite was formerly quarried for the manufacture of lime near Caledon, but quarrying in this formation has ceased.

Sand and gravel pits are operated in several places, the most important centres being Maple and Caledon.

No. 28 SAND AND GRAVEL IN SOUTHERN ONTARIO

by

D. F. Hewitt[1]

In 1968 a survey of sand and gravel producers in Southern Ontario, begun in 1967, was completed. Production of sand and gravel, particularly for construction purposes, is on the increase in Ontario. In 1966 production of sand and gravel in Ontario amounted to 94,123,982 tons with a value of $67,245,821. In 1967 the production increased to 98,760,000 tons valued at $70,670,000. A total of over 300 sand and gravel pits were visited by geologists of the Industrial Minerals Section during this survey.

Although supplies of sand and gravel are abundant throughout many parts of the province, deposits near some of the urban areas of large consumption are becoming depleted. In some areas of the province good deposits of high quality sand and gravel are scarce.

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No. 29 SURVEY OF STONE RESOURCES ALONG THE NIAGARA ESCARPMENT SOUTHERN ONTARIO

by

M. A. Vos[1]

Purpose and Scope: A survey of stone resources along the Niagara Escarpment was made with a view to outlining potential areas of quarry development. This survey was undertaken on request of the Quarry Operators Association of the Ontario Mining Association. The area included stretches along the Niagara Escarpment from Niagara Falls to Manitoulin Island. It covers ground between the Escarpment and the Welland River, Grand River and Highway 10 to Owen Sound. Also included is the Bruce Peninsula.

Field work consisted of visiting existing quarries and correlating information from these quarries with the geology of the surrounding area. In areas where no quarries exist the fullest possible information was acquired from surface outcrops. This information was correlated with sections described by T.E. Bolton of the Geological Survey of Canada. On June 7th and 8th the writer participated in an excursion of the Michigan Basin Geological Society on Manitoulin Island.

The information gained from field work served to facilitate the interpretation of logs of waterwells from which much important data were collected during the summer. A trip to Ottawa, from July 16th to July 23rd; made it possible to study the core of oil wells drilled in the area.

Drift thicknesses maps were prepared in areas of potential stone development and many potential areas for quarry development were delineated.

Geology: From Niagara Falls to Waterdown the brow of the Niagara Escarpment is underlain by Lockport Dolomite of Silurian age. From Waterdown north to the Bruce Peninsula the brow of the Escarpment is formed by the Amabel Dolomite. The general dip is to the west and the Amabel and Lockport Dolomites are overlain by the Guelph Dolomite. Formations of the Cataract and Clinton Groups outcrop in the face of the Escarpment.

Economic Geology: The Lockport and Amabel Dolomites of the Niagara Escarpment between Niagara Falls and Acton form the most important stone resource in the Province of Ontario, and 13 quarries in this area supply a major part of the aggregate requirements of the cities from Niagara Falls to Toronto. It is important to ensure this urban area of a sufficient supply of construction aggregate to support a booming construction industry. There has been a tendency on the part of municipalities in the area to prohibit quarry operations within their jurisdictions. The outlining of potential areas for quarry development in the area may assist in formulating zoning regulations which will ensure future quarry development.

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[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

In addition to crushed stone there are 7 quarries producing building stone from the Lockport Dolomite. The largest of these is Queenston Quarries Limited at Queenston. A number of small quarries operate near Wiarton.

Quarries recently opened up and not previously described are:

1) Quarry for production of crushed rock, owned by E.C. King and located in Grey Co., lot 25, con. II S.C.R., Sydenham Township.
2) Quarry for production of building stone, e.g. wall coursing, sills, operated by D. Ross and located in Bruce Co., lot 10, con. XXV, Amabel Township.
3) Ditto preceding, located in same lot and owned by Smithson.
4) Quarry for production of building stone owned by Angelstone Limited and located in Bruce Co., lot 4,con. VIII, Albemarle Township.

In 1966 there was 9,755,762 tons of stone valued at $11,678,958 produced from the Niagara Escarpment.

No. 30 PLEISTOCENE GEOLOGY OF THE BRANTFORD AREA, SOUTHERN ONTARIO

by

W. R. Cowan[1]

Location: The map-area is bounded by latitudes 43°00' and 43°15' north, and by longitudes 80°00' and 80°30' west. The City of Brantford is located near the geographic centre of the area. The mapping of the east half of the sheet was completed during the field season, plus 2/5 of the western half, i.e. approximately that area lying east of a line drawn between Paris and Oakland, Ontario.

General Geology: A very small area of Ordovician shale of the Queenston Formation occurs in the extreme northeast corner of the quadrangle. Silurian sandstone of the Medina Formation also occurs in the northeast corner. Most of the area is underlain by Silurian dolomites of the Guelph-Lockport Formations and by shale, dolomite and gypsum of the Salina Formation, also of Silurian age. To the extreme south a narrow band of Silurian dolomite of the Bertie-Akron Formation is present and in the extreme southwest a small area of Devonian cherty limestone of the Bois Blanc Formation occurs. Surface outcrop is only found in the Guelph-Lockport Formations near Sulphur Springs and in the Salina Formation along the Grand River west of Brantford and along Boston Creek north of Hagersville.

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[1] Geologist, Ontario Department of Mines, Parliament Buildings, Toronto.

Pleistocene deposits include a number of tills including the previously named Wentworth, Halton, Port Stanley, Catfish Creek and Canning tills, and in addition, other tills of which some may be correlative with the above named. Lacustrine sands, silts, clays and varved clays form a considerable portion of the east sheet. Glaciofluvial outwash and valley train gravels comprise a considerable area along the Nith and Grand River spillway systems west of Brantford.

Economic Geology: Gypsum is being extracted from the Salina Formation by the Canadian Gypsum Co. Ltd. of Hagersville. The 4-foot gypsum seam occurs over a wide area but is generally too thin to be economically feasible to work. The lacustrine clays and varved clays constitute a considerable clay reserve which is presently being exploited for the production of clay tiles by the Brantford Clay Products Ltd. and for pottery by the members of the Tuscarora Indian Reserve. The outwash and valley train gravels are presently being extensively worked by several large producers who ship much of their product to gravel deficient areas such as Toronto. In addition a considerable portion of the remaining gravel is under option but there still exists a large untapped reserve.